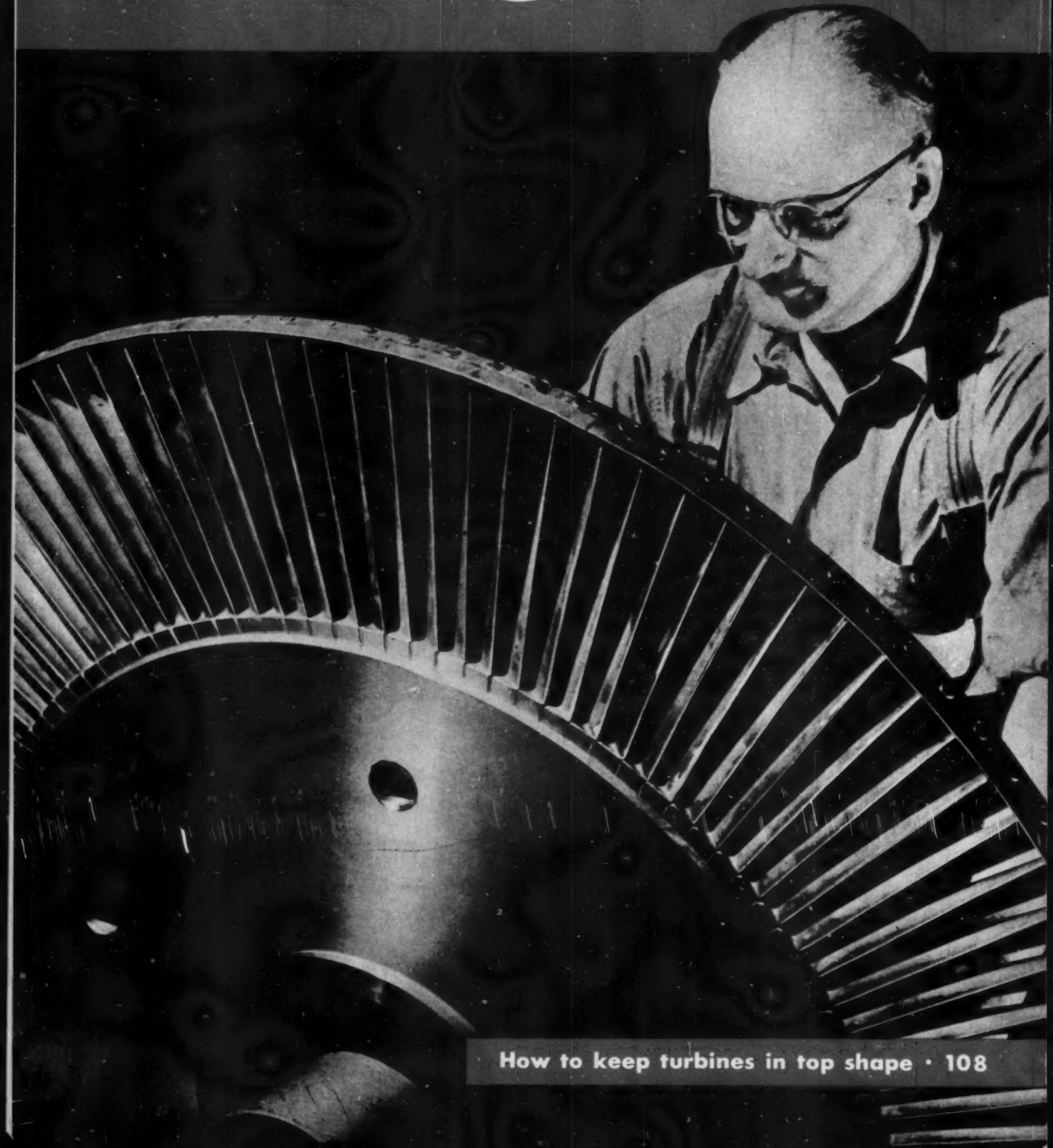
GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

USING INDUSTRIAL TV · 78
FIGURING EXTRACTION CYCLES · 96
SELECTING PUMPS · 114

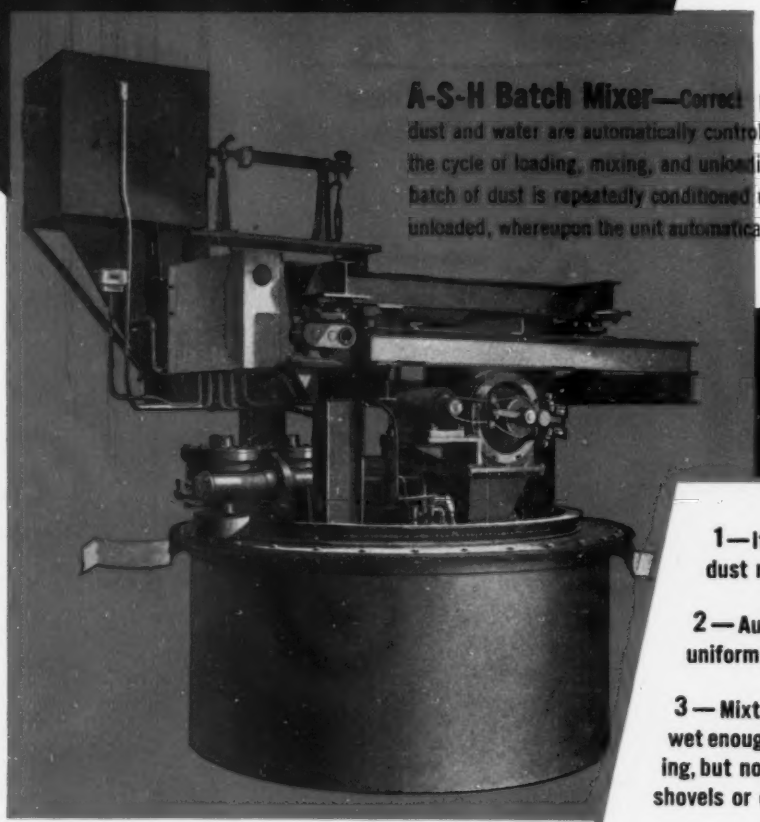
Power

April
1933 · 50¢
A McGRAW-HILL PUBLICATION



How to keep turbines in top shape · 108

Keep your DUST under control



A-S-H Batch Mixer—Correct proportions of dust and water are automatically controlled, as well as the cycle of loading, mixing, and unloading. Batch after batch of dust is repeatedly conditioned until the silo is unloaded, whereupon the unit automatically shuts down.

Why Power Engineers are thinking in terms of the A-S-H Batch Mixer:

1—It completely eliminates local dust nuisance during unloading.

2—Automatic operation insures uniform results.

3—Mixture of dust and water is wet enough to handle without dusting, but not wet enough to stick to shovels or cars.

4—Requires a minimum of enclosed space for unloading area.

If you use trucks or railroad cars for dust disposal, the A-S-H Batch Mixer will make your operation cleaner from start to finish.

Designed to replace conventional continuous unloaders in critical areas, the A-S-H Batch Mixer gives complete protection against accidental release of dust. In addition, the end-product is ideal for handling and transport.

This A-S-H pioneering development can help you solve your air-pollution problem. Write us for further details.

THE ALLEN-SHERMAN-HOFF CO.
Dept. A—259 E. Lancaster Ave., Wynnewood, Pa.
Offices and Representatives in Principal Cities

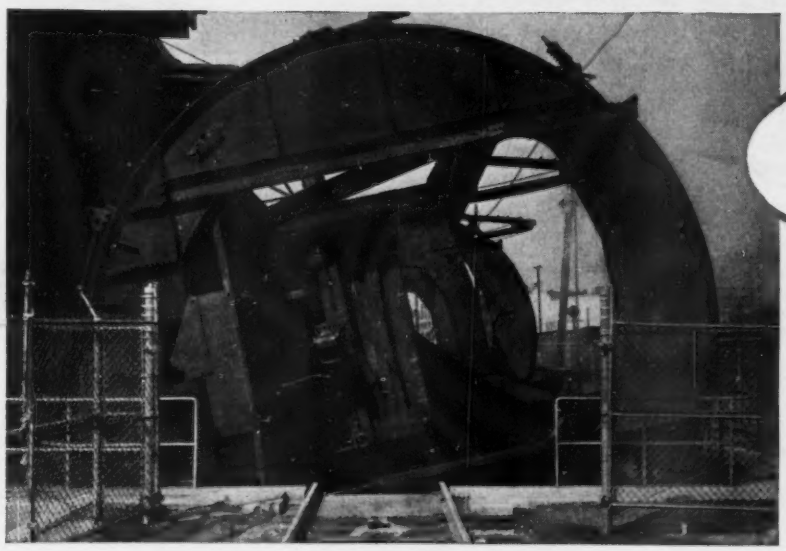
HYDROJET *(hydraulic)* **HYDROVAC** *(pneumatic)*

materials handling systems

Why Link-Belt builds both...

Car Shakers

EASIER ON CARS with minimum noise level . . . thanks to exclusive low-frequency vibration. The Link-Belt Car Shaker helps hopper cars empty themselves. Even hard-packed loads come "broom clean" in a matter of minutes. Especially good for damp, sticky materials. Write for Book 2345.



Rotary Dumpers

BOTTOMS UP . . . empties 90 ton car every 60 seconds or less by simply turning car upside down (including return to upright position)! That's how fast Link-Belt Rotary Car Dumper unloads gondolas. Simple, automatic, foolproof. Takes all open-type cars—any length, width or height . . . up to 90-ton or 120-ton capacity. Book 2048-A has complete data.

Read how you can empty railroad cars fast, gently—at lower cost

YOU'LL get push-button car-unloading with either the Link-Belt automatic Rotary Dumper or the low-frequency Car Shaker. Both of these Link-Belt products can whisk gondola cars "broom-clean" in a remarkably short time.

We build the Rotary Dumper for large users . . . the Car Shaker for smaller operations. That's why you can be sure you get the right railroad car unloader for your particular requirements. Each of these precision-engineered products reduces operational hazards, minimizes injury possibilities, cuts costly demurrage charges.

If you empty a few gondola cars a day—or several thousand a week, call the Link-Belt district office nearest you. Get all the facts on how you can cut your railroad car unloading costs.

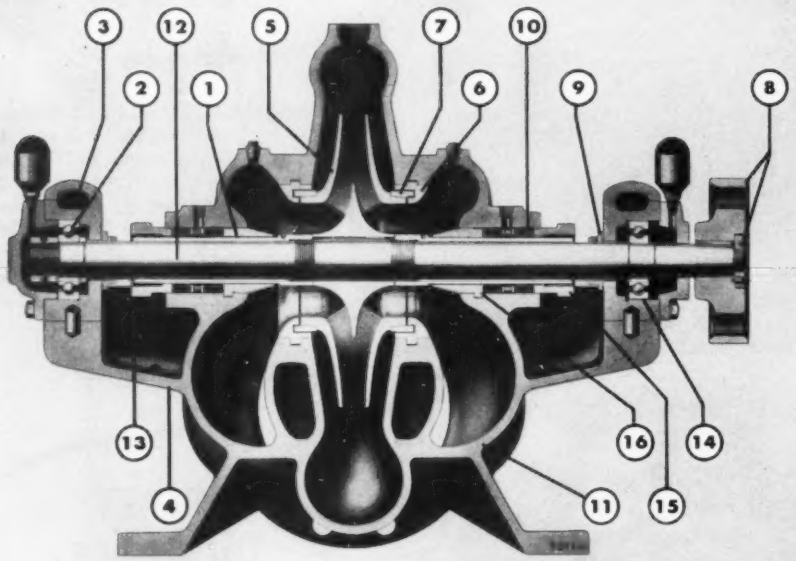
LINK-BELT

CAR SHAKERS and ROTARY DUMPERS

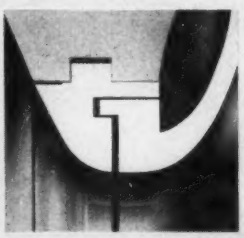
LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 13.202

DE LAVAL
SINGLE STAGE
CENTRIFUGAL PUMPS

for dependable industrial service



Labyrinth wearing rings minimize leakage...maintain high efficiencies



Labyrinth rings used in these De Laval pumps retard flow of water through labyrinth passage.

Flat rings showing relatively unimpeded flow of water.

① **Shaft Sleeves** are screwed on, to abut the impeller and make a water-tight joint. Sleeve expands freely and independently of shaft when temperatures change. There is no tendency to buckle.

② **Thrust Bearing** locates rotor axially.

③ **Bearing Caps** easily removable for maintenance.

④ **Bearing Brackets** scraped to lining bars for perfect alignment.

⑤ **Impeller** hydraulically balanced, finished on all surfaces.

⑥ **Labyrinth Wearing Rings** held accurately in machined grooves in both case and cover.

⑦ **Impeller Wearing Rings** threaded on impeller, opposite to rotation.

⑧ **Flexible Coupling** ground on all exposed surfaces and statically balanced, complete coupling supplied, pump half mounted on taper so that it can be easily removed. Check nut locks coupling on taper.

⑨ **Deflector** keeps water out of bearing.

⑩ **Stuffing Boxes** extra deep; lantern rings for water sealing.

⑪ **Pump Case** horizontally split; machined to limit gages.

⑫ **Steel Shaft** ground to limit gages.

⑬ **Drip Boxes** large; provided with drain openings.

⑭ **Radial Bearing** free to move axially, thus avoiding temperature strains.

⑮ **Glands** split horizontally.

⑯ **Protecting Bushings** renewable.

You can count on the performance of the De Laval Single Stage Centrifugal Pumps because they are precision-made to high manufacturing standards and incorporate the many quality design features shown in the cross-section.

They operate at high or low speeds, at high or low heads...with maximum efficiency.

For example, De Laval G, I and K Single Stage Double Suction Pumps have a capacity range of 175 gpm to 6,000 gpm, and heads to 300 feet. They are available in sizes ranging from 4" suction and 3" discharge to 14" suction and 12" discharge. Write for Bulletin 1002.

DeLaval also furnishes larger centrifugals for capacities up to 70,000 gpm. Bulletin 83-29R sent on request.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

815 Nottingham Way, Trenton 2, New Jersey

DL 198

Power

APRIL 1953 • VOLUME 97 NUMBER 4

ENGINEERING AND MANAGEMENT

Battle report on air-pollution control	73
Today's engineering designs cut process-pump costs	77
TV sees where you can't look	78
Pumped storage capacity improves big power system's operation	84
Diesel governors—II: What does speed regulation mean?	87
To burn wood efficiently choose well-designed combustion chamber	90
Boiler scale wages 5-pronged attack to cover surface areas	94
Comparing automatic-extraction steam turbines	96
How to space poles in perspective	100
Data sheet: Hydraulic conversion factors for special pipes	101

PLANT OPERATION AND MAINTENANCE

Poor operation brings on replacements			105
Inspect and maintain your steam turbines right			108
Aligning flexible couplings and machinery with indicators			112
Topnotch film on centrifugal-pump selection			114
Give "zing" to your diesel-fuel pumps			118
Here are time-tested ways to clean coil insides			120
Get to know moving stairs before they catch up with you			122
Practical ideas	126	How to	140
Plant problems	132	Headwork	142
Argument corner	138	Marmaduke Surfaceblow	144

READER SERVICE SECTION

Defense Digest: Roundup of mobilization news and trends			148
Power news	150	New free bulletins	165
Technical briefs	152	George Edwards	168
Plant equipment news	156	My biggest boner	240

April 1953 POWER Vol. 97—No. 4

POWER (with which are consolidated *Science and Industry, The Engineer Review, The Engineer, The Stationary Engineer* and *Operating Engineer*) is published monthly with an additional directory number in June, by McGraw-Hill Publishing Company, Inc. James H McGraw (1860-1948), Founder. PUBLICATION OFFICE: McGRAW-HILL BUILDING, 330 W 42nd St, New York 36, N. Y.

EXECUTIVE, EDITORIAL and ADVERTISING OFFICES: 330 W 42nd St, New York 36, N. Y. Curtis W McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A Gerardi, Vice-President and Treasurer; John J Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J E Blackburn, Vice-President and Director of Circulation.

SUBSCRIPTIONS: Address correspondence to POWER, Subscription Service, 330 W 42nd St, New York 36, N. Y. Allow one month for change of address. Subscriptions are solicited only from executives, engineers and supervisory personnel engaged in design, operation and maintenance of power, light, heat and other plant services in utilities, construction firms, industrial and service plants. Position and company connection must be indicated on subscription orders.

Single copies: U. S. and possessions, Canada 50¢; all other $1.50. Subscription rates—U. S. and U. S. possessions: $4.00 for one year, $6.00 for two years, $8.00 for three years. Canada: $6.00 for one year, $10.00 for two years, $12.00 for three years. All other countries: $15.00 for one year, $25.00 for two years, $30.00 for three years. Entered as second-class matter January 26, 1949 at the post office at New York, N. Y. under Act of March 3, 1879. Printed in U.S.A.

Copyright 1953 by McGraw-Hill Publishing Company, Inc. All rights reserved.

POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index, which is available for 50¢ from the editorial offices.

TURBINE MAINTENANCE—carried out regularly and with skillful care—keeps these inherently reliable units ringing up ever better availability records. Our cover picture, taken in De Laval's Trenton shops, stands for the many inspections involved—from the builder's painstaking checks aimed at delivering a perfect unit to the periodic checks you make in your plant to keep the machine running sweetly.

For a good picture of what your inspection and maintenance program should include turn to p 108. There Harry Neary passes along a fistful of practical pointers gained in some 30 years of experience in building, designing and servicing turbines.

Next month . . .

■ Ever since the idea of mixing two synthetic resins in a single bed came along, engineers have been wondering what's the best allround answer for demineralizing—2-step setup or mixed-bed layout? A May article gives results of careful, extensive tests, sets up some good guideposts of fact to steer your thinking on this question.

■ Remember Don Swift's shorts on trouble-shooting? Next month we launch a new Swift series, this time on getting a new plant built and operating.

■ For some ten years now, a number of U.S. firms have been quietly working on the free-piston power plant, but most of the news has been made by European builders unhampered by security restrictions.

POWER editors, long familiar with what's going on here, have itched to bring the story to you. In April we plan to do it—a roundup of American developments to date and some prognostications for the future.

■ "Knots" sounds like Boy Scout stuff to most of us, but they're mighty important to good, safe rigging. For practical know-how, see next issue.

. . . and future months

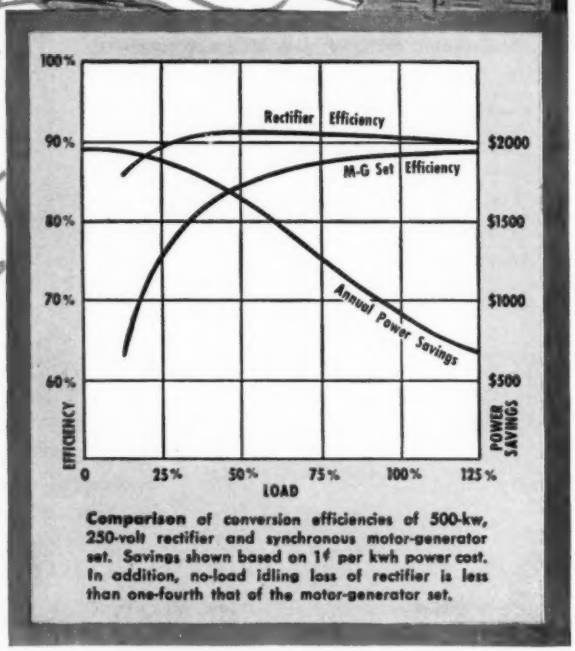
■ *Compressing Air* is the subject of our next handbook section. Lots of dope on typical compressors, auxiliaries, plant air systems—also on selecting, operating and maintaining equipment.

HERE'S PROOF of Low-Loss Conversion

TO OBTAIN economical dc power for arc furnace and blooming mill auxiliaries, West Virginia Steel & Manufacturing Company recently installed mercury arc rectifiers.

The factory-packaged Allis-Chalmers unit includes duplicate 500-kw, 250-volt rectifiers, with tube, breaker, control, and metering compartments, plus dc and ac plant feeder breakers. Since transformers could be installed outdoors, the assembly departs from the usual double-ended arrangement.

Rectifiers were chosen for their high conversion efficiencies *plus* simplified foundation needs, easy installation and minimum maintenance. And Allis-Chalmers units incorporate continuous excitation, grid phase control, internal cooling and enameled anode seals.



Comparison of conversion efficiencies of 500-kw, 250-volt rectifier and synchronous motor-generator set. Savings shown based on 1¢ per kwh power cost. In addition, no-load idling loss of rectifier is less than one-fourth that of the motor-generator set.

Use A-C's Engineering Experience

By calling your A-C representative, you can put A-C's quarter century of rectifier application experience to work on your power conversion problems. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3989

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

Power

P W SWAIN *Editor*

L N ROWLEY	*Executive Editor*
F A ANNETT	*Contributing Editor*
S M ELONKA	*Associate Editor*
T G HICKS	*Associate Editor*
J C McCABE	*Associate Editor*
J J O'CONNOR	*Associate Editor*
B G A SKROTZKI	*Associate Editor*
C F SANDERS	*Assistant Editor*
C F MARSCHALEK	*Art Editor*

DOMESTIC NEWS BUREAUS: *Atlanta, Cleveland, Detroit, Houston, San Francisco, Washington*
WORLD NEWS OFFICES: *London, Paris, Frankfort, Tokyo Manila, Rio de Janeiro, Mexico City*

SHELTON FISHER *Publisher*
CLARK BOUGHTON *Sales Manager*

DISTRICT MANAGERS
W W QUARLES, 330 W 42nd St, New York 36, N. Y.
C R LONG, Architects Bldg, Philadelphia 3, Pa.
J E SLATER, 350 Park Square Bldg, Boston 16, Mass.
W K PONDER, 1510 Hanna Bldg, Cleveland 15, Ohio
L W ROMIGH, 520 N Michigan Blvd, Chicago 11, Ill.
J E DEAN, 856 Penobscot Bldg, Detroit 26, Mich.
J H CASH, First National Bank Bldg, Dallas 1, Tex.
JOHN OTTERSON, 68 Post St, San Francisco 4, Calif.
J H ALLEN, 1111 Wilshire Blvd, Los Angeles 17, Calif.

...with Power readers...

TWICE IS TOO MUCH? . . .

You sort of stubbed your toe on page 3 of the March issue, didn't you? Under the heading "Next month . . ." you had a squib about an article on textile-mill economizers. The article referred to actually appeared in the same issue (March, p 84). And I seem to remember the same squib, under the same heading, page 3 in the February issue. What gives?

Philadelphia, Pa. HARRY MACNEAL

You're so right, Reader MacNeal. We still haven't been able to figure out what happened. We'd like to blame the printer for sticking in a few lines of type that were kicking around from the previous issue, but suspect we fell victim to a trouble all editors suffer—the problem of knowing just what issue you're working on when you're in the midst of several. Right now, for example, we're reading proofs on this issue (April—we hope), readying manuscripts for May, planning the contents of June and July. And the early March winds are whistling outside as we write this. Can you blame us for being a bit confused about dates?—ED.

COMPRESSOR LUBRICATION . . .

I am very much interested in the article in the February issue, pp 118, 119 ("Top

(*Continued on page* 198)

...lines and bylines

Harry Neary

MARK ANTONY had to beg fellow Romans for the use of their ears when he had something important to say. But when Harry Neary talks machinery, on any occasion, engineers and users of turbines, pumps, compressors and gears gladly cock both ears and listen.

His conscientious advice on application, installation and maintenance of such equipment is filtered through a background of almost 30 years of living with these problems. He joined De Laval in 1923, has shouldered the responsibilities of chief test engineer, research and design engineer, service and maintenance engineer. Since 1948, he's been De Laval's special technical adviser on users' problems. And it's just that all-important user angle he takes in his article on turbine maintenance, p 108.

Harry began his studies in Trenton, and it has been his headquarters ever since starting with De Laval. Mechanical and heat-power engineering courses at Drexel were completed in 1932.

Matt Jones

THE BLACK GANG (engineering dept to landlubbers) is where Matt Jones got his start. He put in eight years on tugs, submarines and battleships before coming ashore for good. Since seagoing days he's been asst chief and chief, supt of power and maintenance and, for a change, personnel and production manager in the laundry and dry-cleaning industry. And he turned down a top job in one of the East's largest laundries to go back to God's country—Texas.

Back in that great state, he took on two jobs in the hospital field. At Baylor Hospital for something over four years, he garnered the experiences he recounts on pp 105-107.

Now in sales work with headquarters at Dallas, he takes a typical Texas poke at us New Yorkers—says we were sorta slow in putting together his article. As he puts it, "I should have come up to New York to see you fellows. We could have gone to the Bent Propeller Bar and finished the story in nothing flat—and had a lot more fun!"

E V Pollard

READERS may remember Ed Pollard's previous article, "Now! Triple-Automatic Steam Turbines" (Feb 1950). He's with us again on the subject of automatic extraction — this time with practical helps for figuring these sometimes complex cycles (p 96).

He speaks with authority, for his work with General Electric's medium steam-turbine department, at Lynn, Mass., gives him responsibility for steam design of all land turbine propositions.

Pollard is a native of Lynn, prepared there for MIT (BSME, 1917). He holds a professional license in Massachusetts, is a junior member of ASME. His working interest in steam turbines carries over to writing about them—he's author of many technical papers and articles in addition to those appearing in our favorite publication.

52 REPEAT

for B&W Integral-Furnace

from One Automotive

Seventeen years ago, in 1936, a large automobile manufacturing concern ordered its first B&W Integral-Furnace Boiler. Since then, 52 times—under 52 different sets of circumstances—the customer has come back for more units of this type. Total steam capacity installed and on order now amounts to over 5,750,000 lb/hr, with unit capacities ranging from 20,000 lb/hr to 190,000 lb/hr.

Like this user's own splendid reputation for customer loyalty, repeat orders represent a high percentage of total B&W Integral-Furnace Boiler sales . . . testifying to the high availability, over-all economy, and operating efficiency of these B&W units. Their cost-saving advantages, listed below, have won industry-wide endorsement as reflected in sales of these units to date, totaling well over 191,000,000 lb of steam per hour.

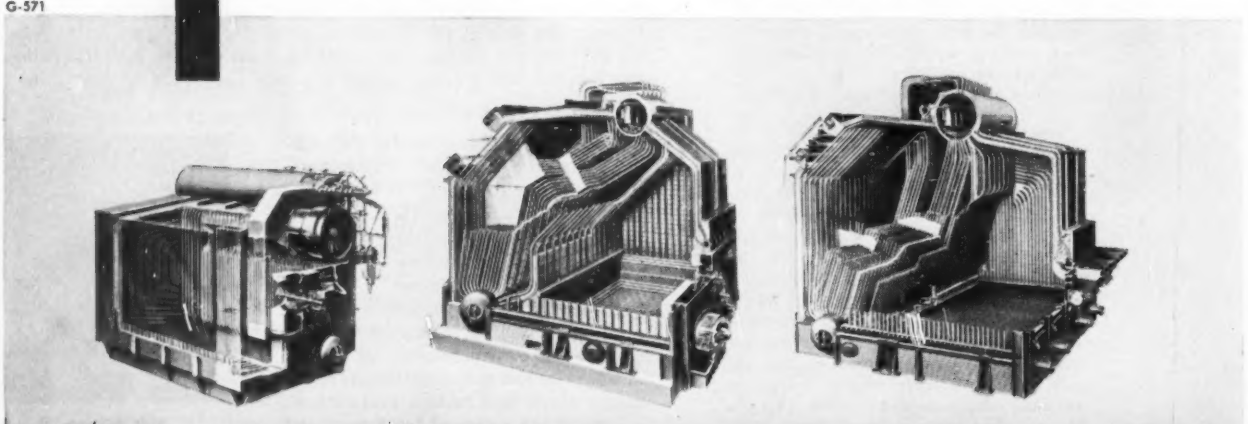
Modern B&W Integral-Furnace Boilers include designs ranging from as little as 2800 lb of steam per hr, to 350,000 lb/hr, for unusually wide coverage of industrial, commercial and institutional steam requirements.

Write today for descriptive literature covering any or all of the boilers in the B&W Integral-Furnace family, to help you in planning *your* company's next expansion or modernization program.

COST SAVING FEATURES

Minimum floor space and headroom requirements
High fuel economy
Smokeless combustion
Adaptable to all fuels and firing methods
Economical fast steaming
Water-cooled furnace
Clean, dry steam at all ratings even with high boiler water concentrations
Quick response to wide and heavy load swing demands
Easy to inspect and clean
High availability with least attention

G-571



TYPE FM
2,800—28,000 lb/hr
up to 250 psi
Oil and Gas Firing

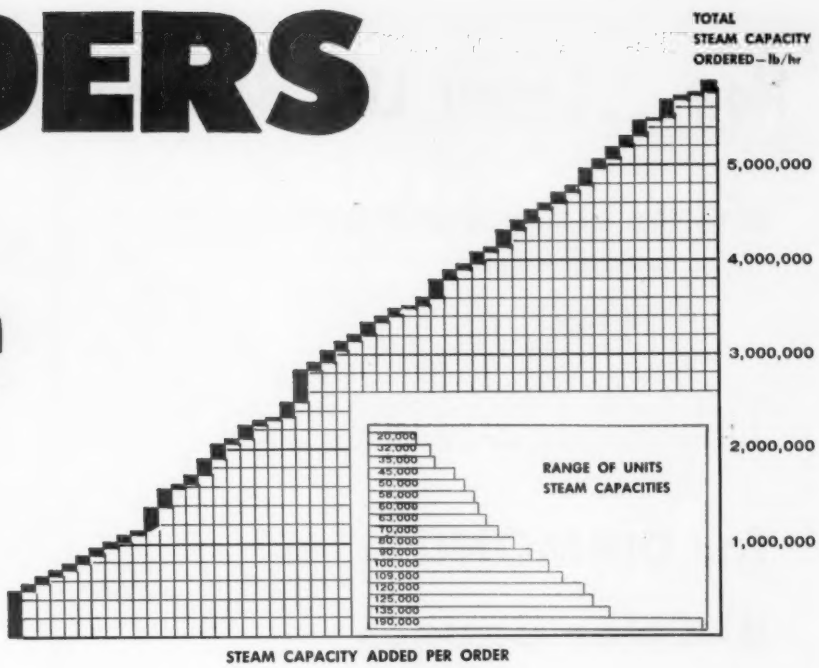
TYPE FF
8,000—50,000 lb/hr
up to 600 psi
Stoker, Oil, and Gas Firing

TYPE FJ
30,000—70,000 lb/hr
up to 800 psi
Stoker, Oil, and Gas Firing

ORDERS

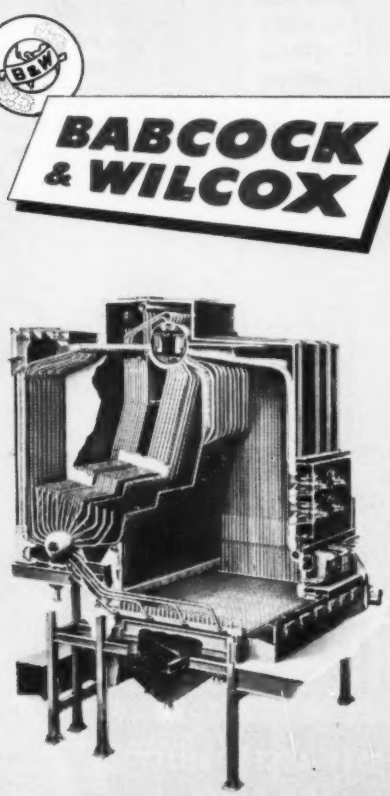
Boilers

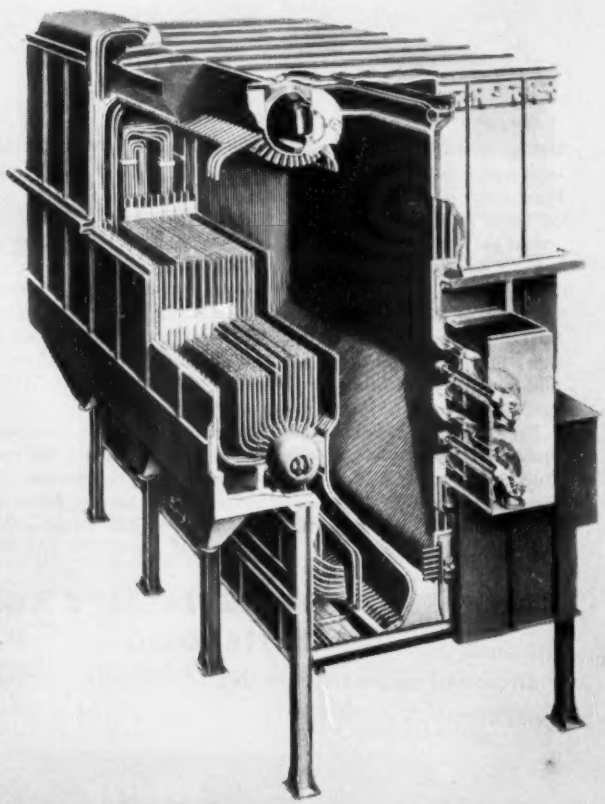
Customer



B&W

BABCOCK & WILCOX





TYPE FL
60,000—150,000 lb/hr
up to 1050 psi
Stoker, Oil, and Gas Firing

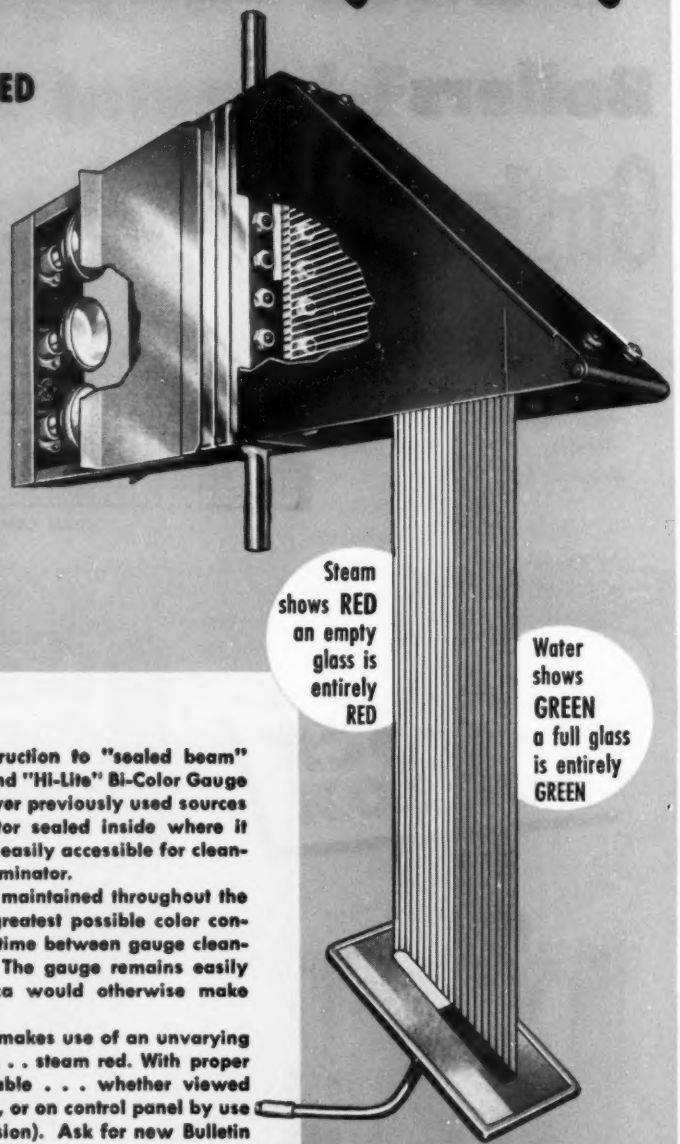
TYPE FH
50,000—350,000 lb/hr
up to 1050 psi
Pulverized Coal, Oil, and Gas Firing

Now... Longer Life Between Gauge Cleanings

with the NEW and IMPROVED

"HI-LITE" ILLUMINATOR

for DIAMOND Bi-Color Gauges



Using lamps similar in general construction to "sealed beam" automobile headlamps, the new Diamond "Hi-Lite" Bi-Color Gauge Illuminator is a definite improvement over previously used sources of light. This type lamp has a reflector sealed inside where it *cannot* get dirty. The face of the lamp is easily accessible for cleaning . . . as are all other parts of the illuminator.

A very high level of illumination is maintained throughout the long life of the lamps. This provides greatest possible color contrast at water level . . . permits longer time between gauge cleanings, therefore reducing maintenance. The gauge remains easily and clearly readable when dirty mica would otherwise make reading difficult.

The Diamond Bi-Color Water Gauge makes use of an unvarying optical principle to show water green . . . steam red. With proper illumination, water level is unmistakable . . . whether viewed directly, or through a system of mirrors, or on control panel by use of Diamond "Utiliscope" (Wired Television). Ask for new Bulletin No. 1051 U.

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited—Windsor, Ontario

GREATER COLOR CONTRAST AT WATER LEVEL

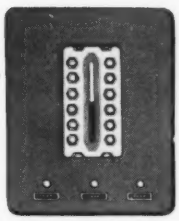
EASY ACCESSIBILITY FOR QUICK MAINTENANCE

REDUCED MAINTENANCE COSTS

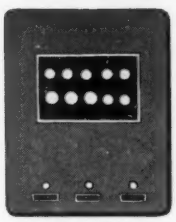
Write for NEW BULLETIN NO. 1051

4819

RAPIDLY GROWING *LIST OF UTILITIES*
Using the DIAMOND "UTILISCOPE"
(WIRED TELEVISION)



Boiler water level observation



Burner pilot observation

Boiler furnace combustion observation

Stack smoke discharge observation

Utilities listed below have purchased the Diamond "Utiliscope" for one or more of the uses shown. Images are brought to the boiler control panel where the operator can see them at all times.

The "Utiliscope" is simple, stable, remarkably durable. It requires no technical skill for operation. Cost is low and is quickly amortized by labor saving and improved operation. Write for Bulletin 1025A.

Alabama Power Co.
Barry Steam Station

***Appalachian Electric Power Co.**
Philip Sporn Plant
Kanawha River Plant

***Board of Water & Electric Light Comm.**
Ottawa Station
Lansing, Mich.

Central Hudson Gas & Electric Corp.
Danskammer Station

Charbonnazza de France
Power Station De Chocques

***Cincinnati Gas & Electric Co.**
Miami Fort Station
Walter C. Beckjord Station

Cleveland Electric Illuminating Co.
Eastlake Plant

***Commonwealth Edison Co.**
Fisk Street Station
Ridgeland Station
State Line Station

***Consolidated Edison Co.**
Hellgate Station
Hudson Avenue Station
Waterside Station
East River Station
Astoria Station

***Dayton Power & Light Co.**
Hutchings Station

Detroit Edison Co.
St. Clair Station

***Duke Power Co.**
Dan River Station
Lee Station
Riverbend Station
Buck Station

***Elecktricitateetsakskabet**
Kydnby Power Station
Isefyordraerkat,
Denmark

***Electricite de France**
Nantes Chivire Station
Arrighi Station

Gulf States Utilities
Nelson Station

***Illinois Power Co.**
Wood River Station

***Indiana & Michigan Elec. Co.**
Twin Branch Station
Tanners Creek Station

Indianapolis Power & Light Co.
White River Station

Kansas Gas & Electric Co.
Murray Gill Station

***Long Island Lighting Co.**
Port Jefferson Station
Far Rockaway Station
Glenwood Landing Station

Louisiana Power & Light Co.
Nine Mile Point Station

Monongahela Power Co.
Albright Station

***New York State Electric & Gas Corp.**
Goudey Station
Greenidge Station

***Niagara Mohawk Power Corp.**
Dunkirk Station
Oswego Station
Huntley Station
Albany Steam Station

***Northern Indiana Public Service Co.**
Michigan City Station

Northern States Power Co.
Black Dog Station

***Ohio Power Co.**
Tidd Station
Philip Sporn Plant
Muskingum River Plant

***Oklahoma Gas & Electric Co.**
Mustang Station

Pacific Gas & Electric Co.
Moss Landing Steam Plant

***Philadelphia Electric Co.**
Delaware Station
Richmond Station
Cromby Station

***Public Service Co. of Northern Illinois**
Waukegan Station
Dixon Station
Will County Station

***Public Service Co. of Indiana**
Noblesville Station
Wabash River Station

Public Service Electric & Gas Co.
Kearny Station

San Diego Gas & Electric Co.
Silvergate Station

***Societa Edison—Italy**
Centrale de Genova
Centrale de Piacenza

South Carolina Generating Co.
Urquhart Station

***Southern California Edison Co.**
Etiwanda Station
Redondo Station

Southwestern Public Service Co.
Plant X

***Tennessee Valley Authority**
Johnsonville Steam Plant
Widows Creek Plant
Shawnee Steam Plant
Kingston Steam Plant
Colbert Station

Toledo Edison Co.
Acme Station

Union Electric Co. of Missouri
Meramec Station
Venice Station

Virginia Electric Power Co.
Chesterfield Station

West Penn Power Co.
Springdale Station

"UTILISCOPE" REGISTERED U. S. PATENT OFFICE

***Repeat orders have been received from these utilities.**

6303

50th ANNIVERSARY 1903-1953

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO • OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited—Windsor, Ontario

FROM 1 HP. UP...

At JOPPA, all motors

THE MOTOR LINE-UP AT JOPPA

83 on pumps of all types

20 on fans — induced and forced draft, and ventilating

6 on air compressors

69 on crushers, conveyors, coal feeders, etc.

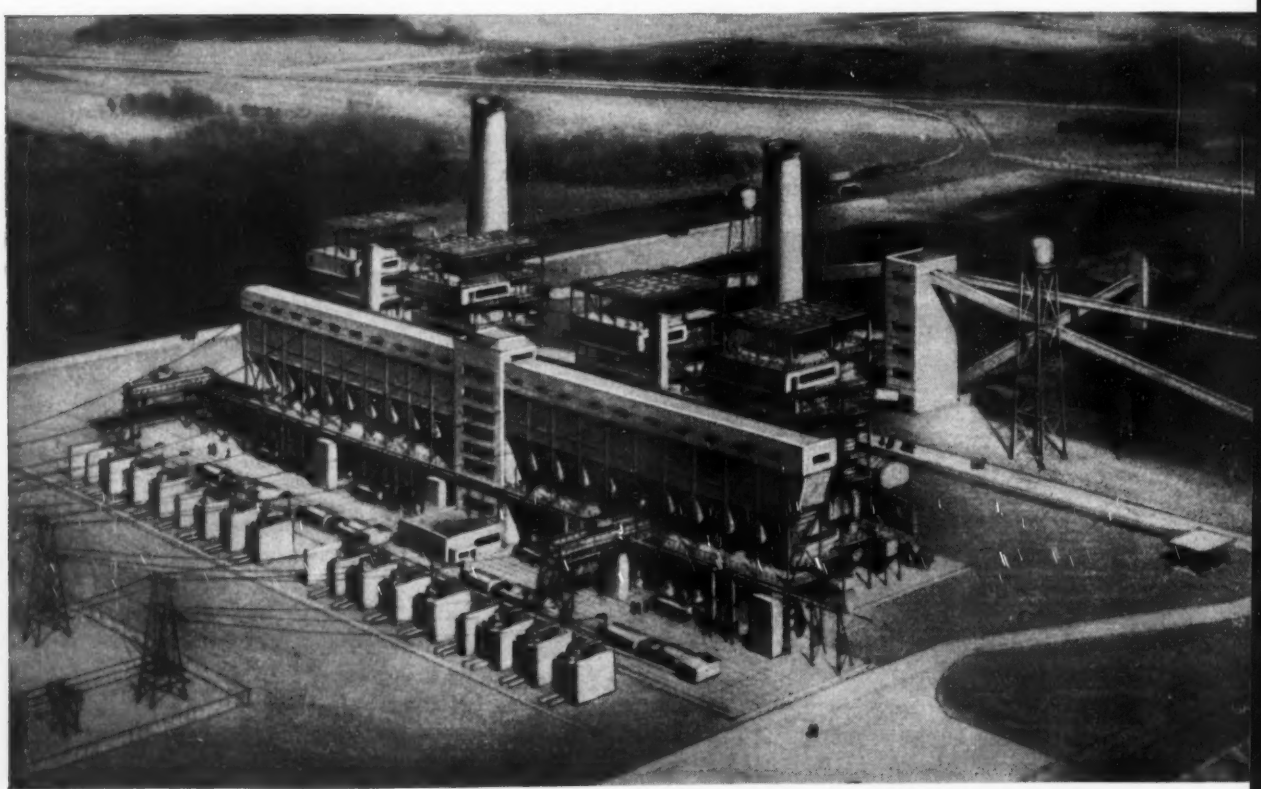
13 on winches, cranes, hoists

11 on miscellaneous service

MOTOR CAPACITIES IN HP include:
1, 1½, 2, 5, 7½, 10, 15, 20, 25, 30, 40, 50, 75, 100, 125, 150, 200, 250, 400, 600, 850, 1250, 2500.

MOTOR ENCLOSURES include:
dripproof, weather-protected (or outdoor splash-proof), totally-enclosed, non-ventilated, and totally-enclosed fan cooled.

MOTOR TYPES include:
synchronous, direct-current, squirrel-cage induction, and wound rotor induction.



are ELLIOTT!

The 652,000-kw Joppa Station, designed and constructed under the direction of Ebasco Services, Inc., New York, N.Y., is the largest outdoor steam-electric station ever to be initially conceived and built in one construction operation. Not only in capacity, but in construction speed too, Joppa sets a new record. Electric Energy, Inc., builders of the plant, represent the combined interests and efforts of the five major utility companies in the area to fill the vast power demand engendered by defense needs. Union Electric Company of Missouri, Central Illinois Public Service Company, Illinois Power Company, Kentucky Utilities Company, and Middle South Utilities, Inc., are the five companies who have pooled their resources to this end.

In this great new plant, all auxiliary motors are Elliott-built. Main auxiliary drives are served by sturdy "Fabri-Steel" motors produced by Elliott's Ridgway Division, while on other auxiliaries are many of the famous Crocker-Wheeler motors, built by the Crocker-Wheeler Division of Elliott Company.

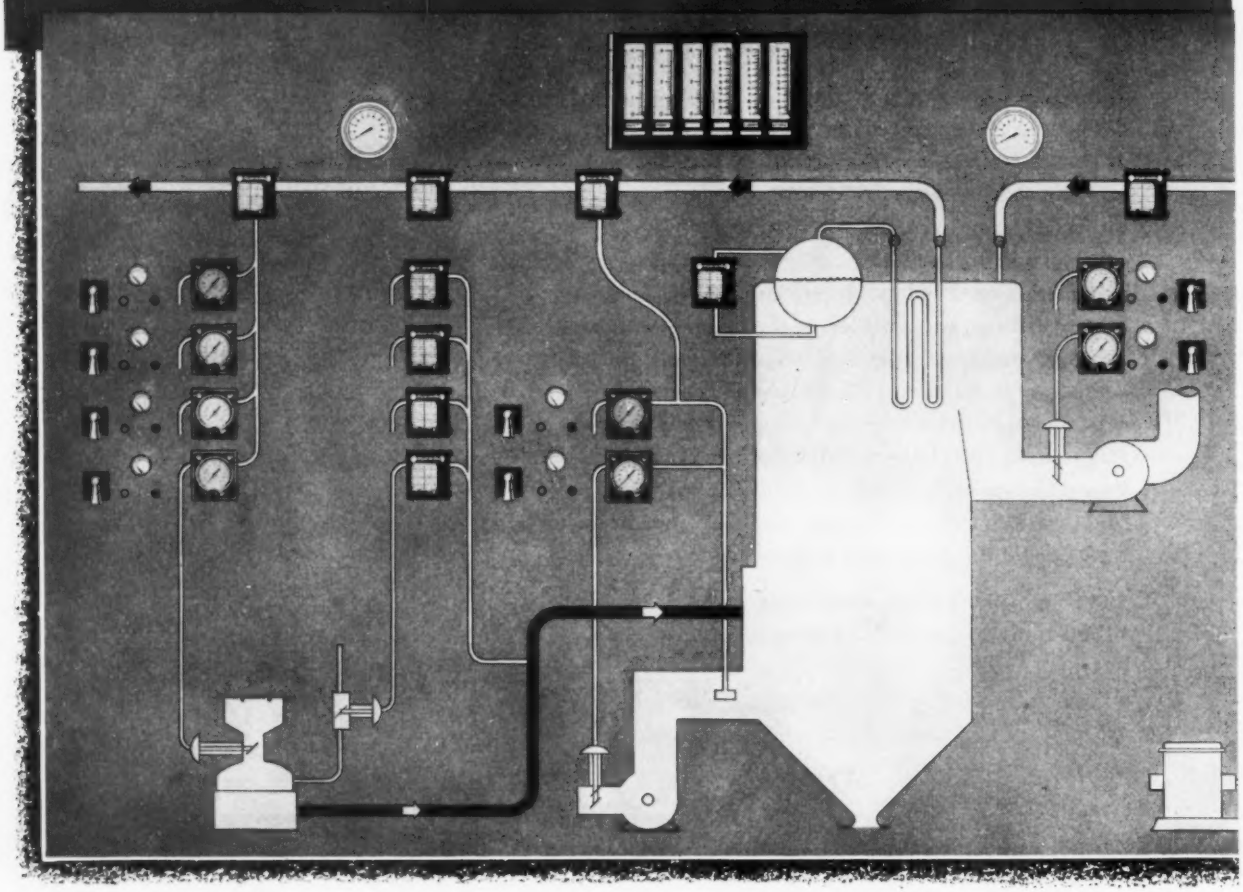
For full details on Elliott Crocker-Wheeler and Elliott Fabri-Steel motors, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

229

RIDGWAY DIVISION — CROCKER-WHEELER DIVISION

. . . a NEW approach to . . .



Graphic panel with miniature instruments. Console or conventional panels also available. Combustion control from steam flow-air flow, or fuel-air ratio . . . feed water from three, two or one influences. Steam temperature control is multi-element. Soot blowing is automatic-sequential. *Write for Bulletin 1007 on complete Copes-Vulcan Boiler Control.*

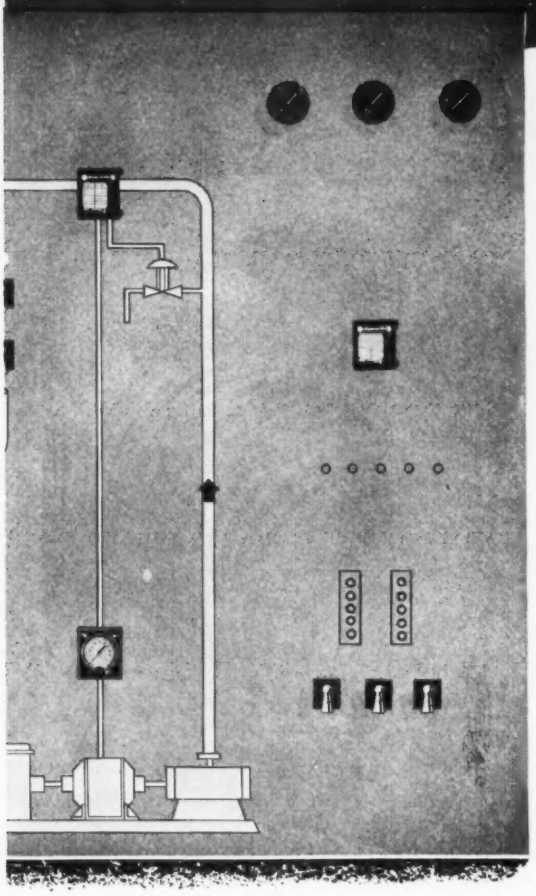
WHAT'S IN A NAME?

COPES has for half a century specialized in the control of boiler feed water flow and pressure, boiler water level—and, more recently, boiler steam temperature.

VULCAN has since 1903 brought soot blowing from an act of drudgery to the ease and convenience of merely pushing a button at a centrally located control panel.

Taylor has for over 100 years led in instruments for measuring and controlling temperature, pressure, flow and liquid level in the process and power fields.

BOILER CONTROL



C·V+T=BBC

COPES · VULCAN + *Taylor* = BETTER BOILER CONTROL

This new formula is based on three old and respected names in power and process controls. Each contributes skills and experience that make the equation add up to Better Boiler Control.

Give us the opportunity to demonstrate how this formula can work to your advantage. The new Copes-Vulcan approach to your boiler control problem will pay off in smoother, safer and more efficient boiler operation.

And Copes-Vulcan assumes undivided responsibility—starting with system design and continuing through the life of the installation with on-the-job service, *whenever* or *wherever* needed.

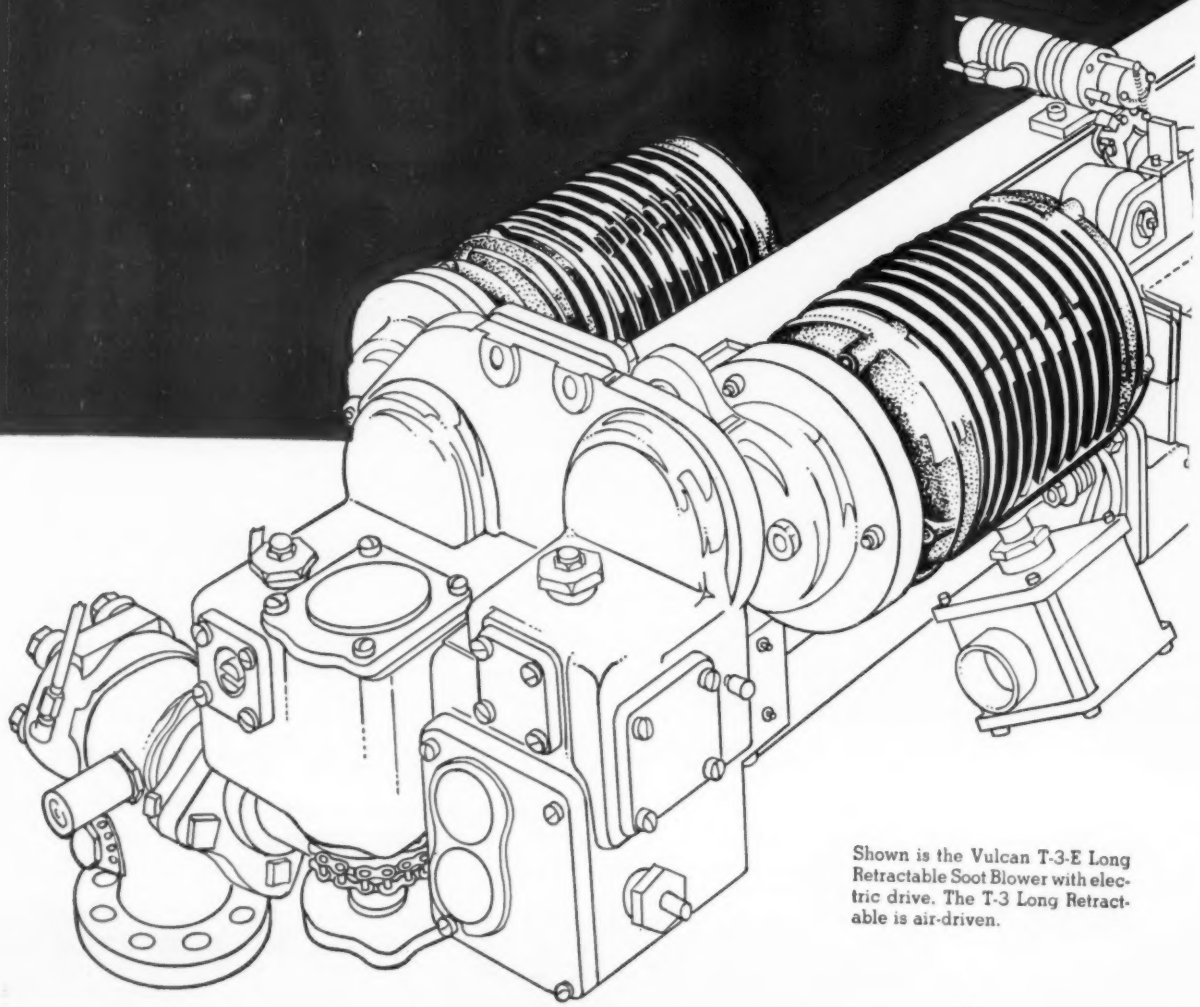
COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

COPES VULCAN

BOILER CONTROL

WITH INSTRUMENTATION
BY *Taylor*

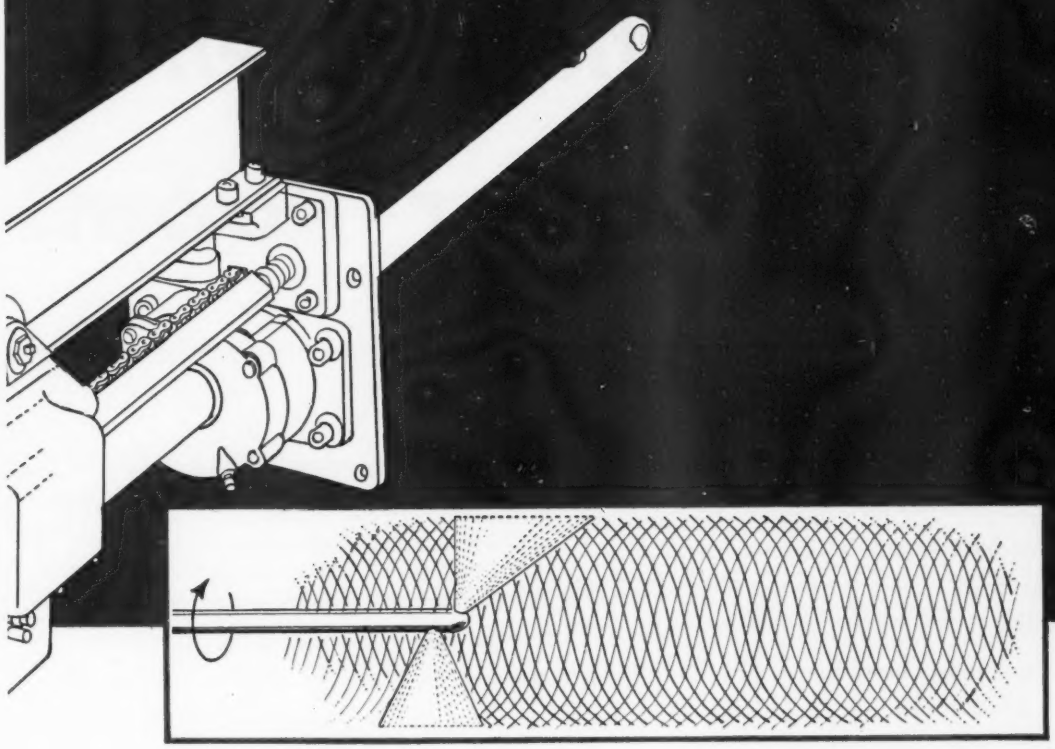
WHY VULCAN



Shown is the Vulcan T-3-E Long Retractable Soot Blower with electric drive. The T-3 Long Retractable is air-driven.

VULCAN Automatic

USES 2 MOTORS



This cleaning pattern—an infinite number of double-helix paths—makes the second motor of a Vulcan Long Retractable Soot Blower a most profitable investment. Two motors cost more—but they are worth more.

To get such thorough cleaning—with the blowing steam or air always cleaning a new path—you must have two motors. One motor moves the lance in and out—the other rotates it. And with the two motors, traversing and rotating speeds are independently adjustable for your exact needs.

This double-helix pattern cuts tube replacement costs. There is no danger of the blowing medium constantly striking—and wearing away—the same part of each tube. Packing life is increased.

These are reasons why Vulcan "Long Retracts" are found on so many new high-duty boilers. Users know Vulcans pay for themselves quickly and often. The story is told in Bulletin 1002. Write for it.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE 4, PENNSYLVANIA

How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

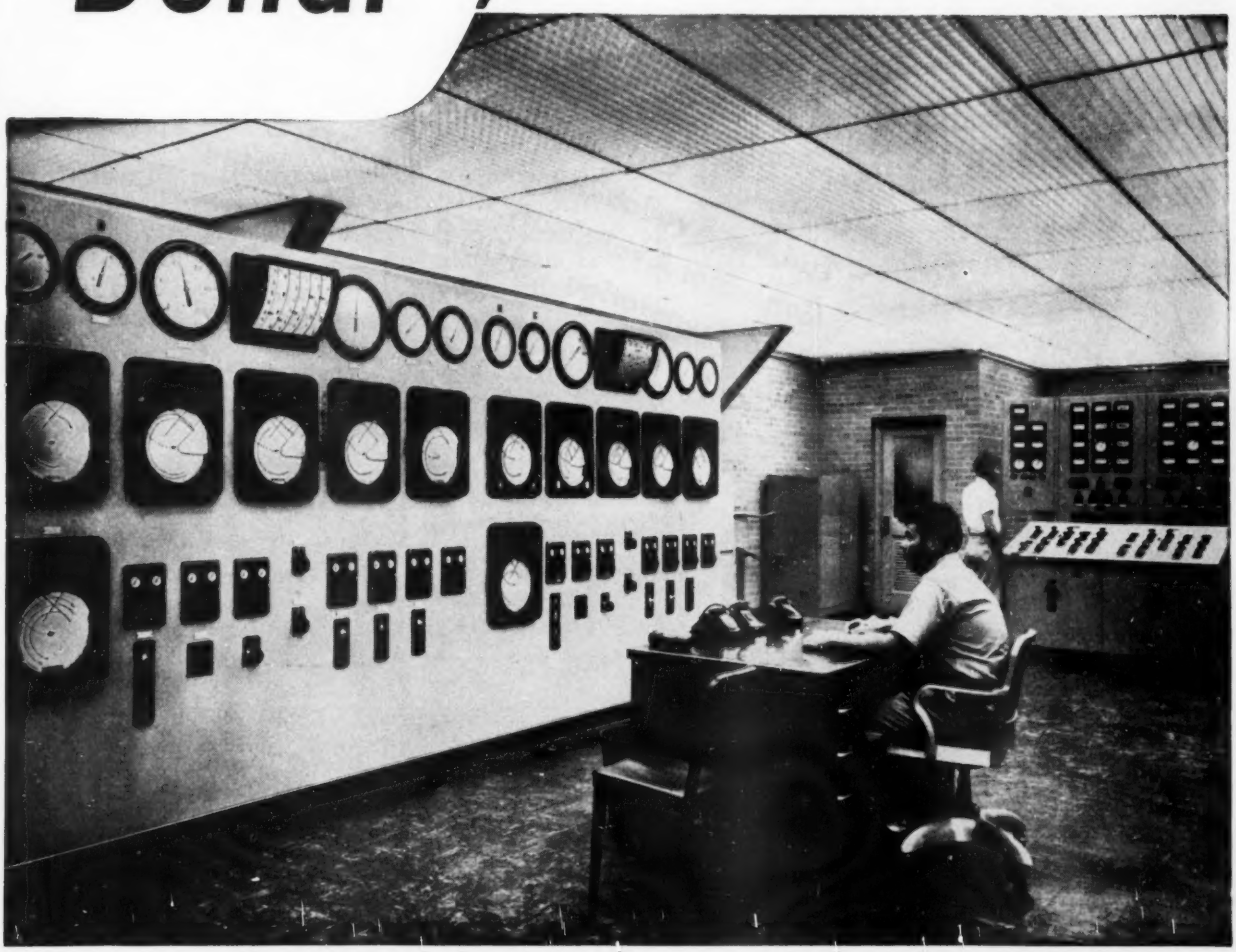
For better "boiler-room investment" efficiency —for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

III-1

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

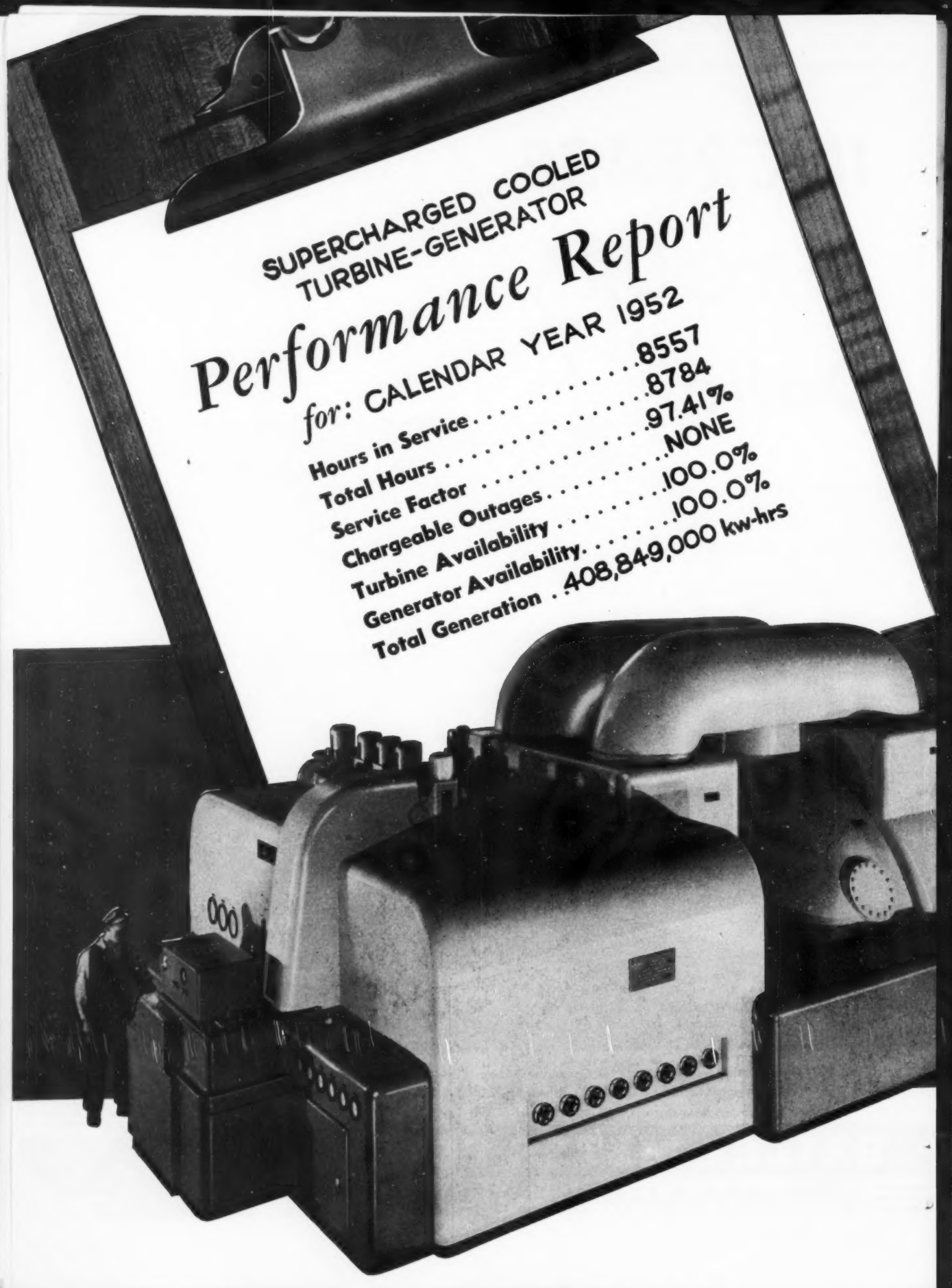
INCREASE of YOUR Dollar



These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 450,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA


SUPERCHARGED COOLED
TURBINE-GENERATOR
Performance Report
for: CALENDAR YEAR 1952
Hours in Service 8557
Total Hours 8784
Service Factor 97.41%
Chargeable Outages . . . . . NONE
Turbine Availability 100.0%
Generator Availability 100.0%
Total Generation . . 408,849,000 kw-hrs

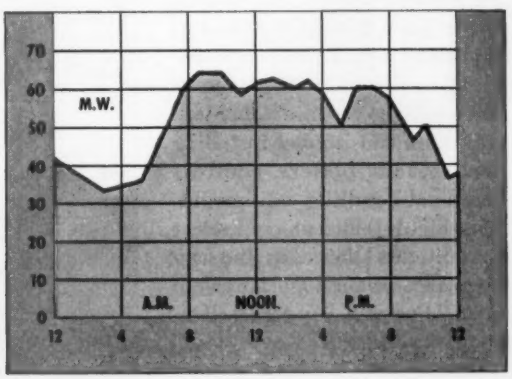
Availability for Duty: 100.0%!

Supercharged Hydrogen Cooling — the greatest advance *ever* made in turbine generator design — has proved itself brilliantly in its first full year's commercial operation!

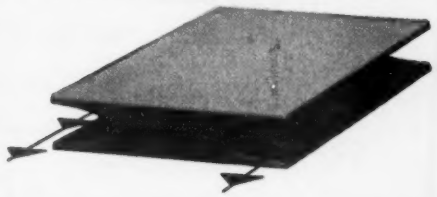
At left is the calendar year 1952 Performance Report on the Allis-Chalmers 60,000 kw steam turbine generator unit at the Edgewater station, Sheboygan, Wisconsin Power and Light Company. Both turbine and generator Availability were 100.0%, with on-the-line Service Factor over the entire year being 97.41%.

Cooling by driving hydrogen at high velocity directly *through* the conductors — supercharging — was first developed and applied by Allis-Chalmers. Supercharging has already permitted increase in generator rating of more than 70% over ordinary hydrogen cooling, with even greater gains forthcoming.

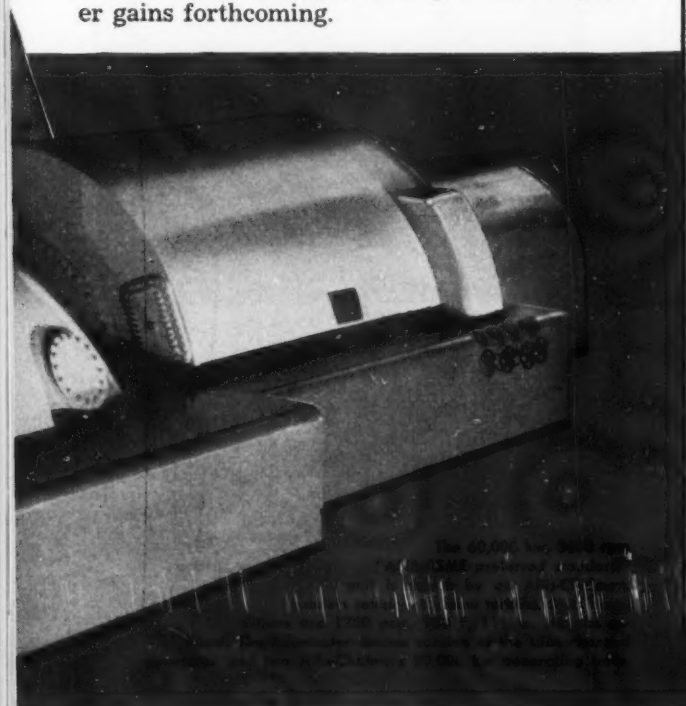
You get the real design advances *first* from Allis-Chalmers, builder of the world's widest range of power plant equipment. When planning a steam-electric power plant, your task will be simpler and results better if you deal with Allis-Chalmers. For complete literature on all products, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3981



Typical daily load cycle of the Sheboygan supercharged unit. It experiences wide load fluctuations because it operates in parallel with base load hydro power. Supercharged units are suited for even this strenuous duty because of high part load efficiency and shorter, more thermally stable construction.



Cross sectional view, showing two turns of typical supercharged conductor construction. The cooling gas is in intimate contact with the copper, removing the heat right where it originates. The heat does not have to migrate through insulation and surrounding metal to reach vent ducts in the rotor teeth or body.



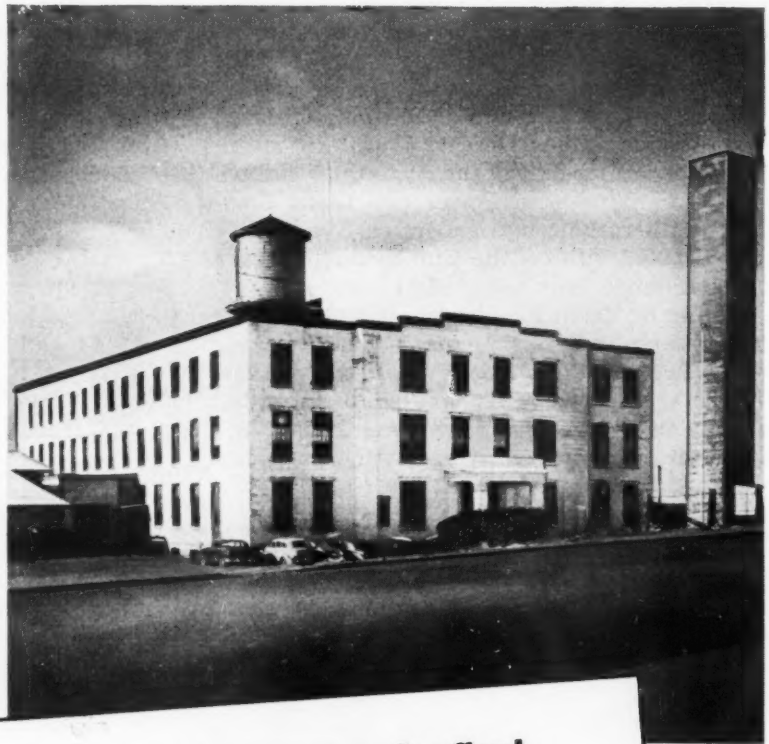
ALLIS-CHALMERS

FIRST with Supercharged Hydrogen Cooling!

"WE GET BIG SAVINGS THE MODERN WAY!

MODERN COAL-BURNING AND HANDLING EQUIPMENT SAVES THIS PLANT MORE THAN 35% ON LABOR ALONE!

This view shows The Welch Grape Juice Company's plant at Westfield, New York. The power plant consumes an average of 700 tons of coal per month. Modernization consisted of installing new stokers, boilers, controls and coal-handling equipment. This highly efficient equipment not only cuts labor costs, but also saves 18% on fuel. The complete installation will pay for itself in about 6 years.



If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs — for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

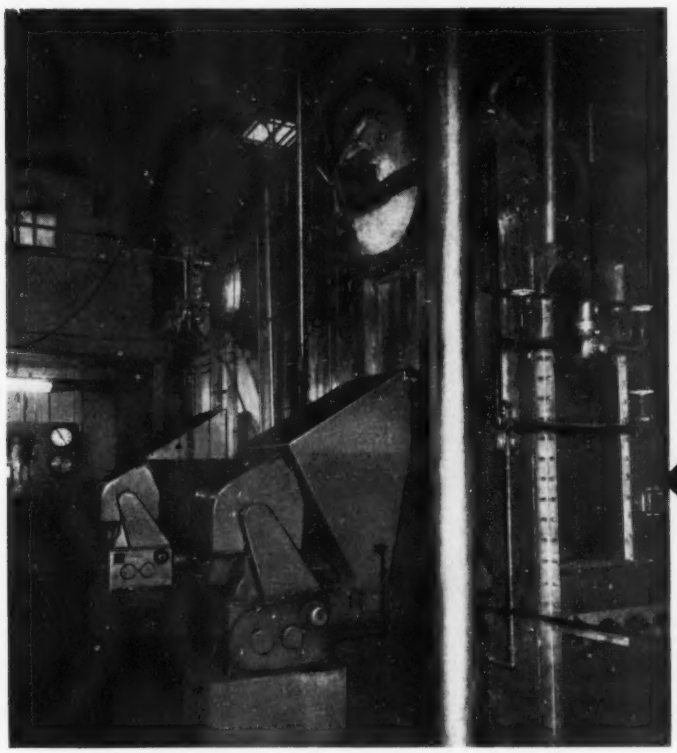
COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more — for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

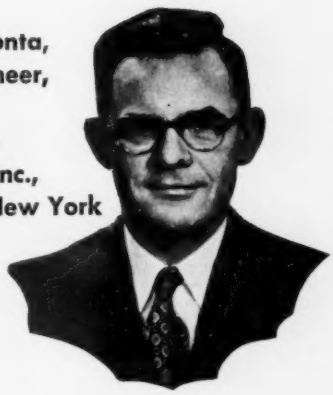
FOR HIGH EFFICIENCY
FOR LOW COST

BY BURNING COAL

Other fuels would cost us far more!"



says
Mr. A. J. Monta,
Plants Engineer,
The Welch
Grape Juice
Company, Inc.,
Westfield, New York



"We analyzed the cost of coal and other fuels before modernizing our power plant. The result is this up-to-date coal installation that delivers steam at half the cost of competing fuels. That's why we say, *for economy you can't beat* bituminous *coal burned the modern way!"*

● Burning bituminous coal the modern way can save you money, too! Labor costs are cut to a minimum with up-to-date coal- and ash-handling equipment . . . modern combustion installations deliver anywhere from 10 to 40% more power from every ton of coal!

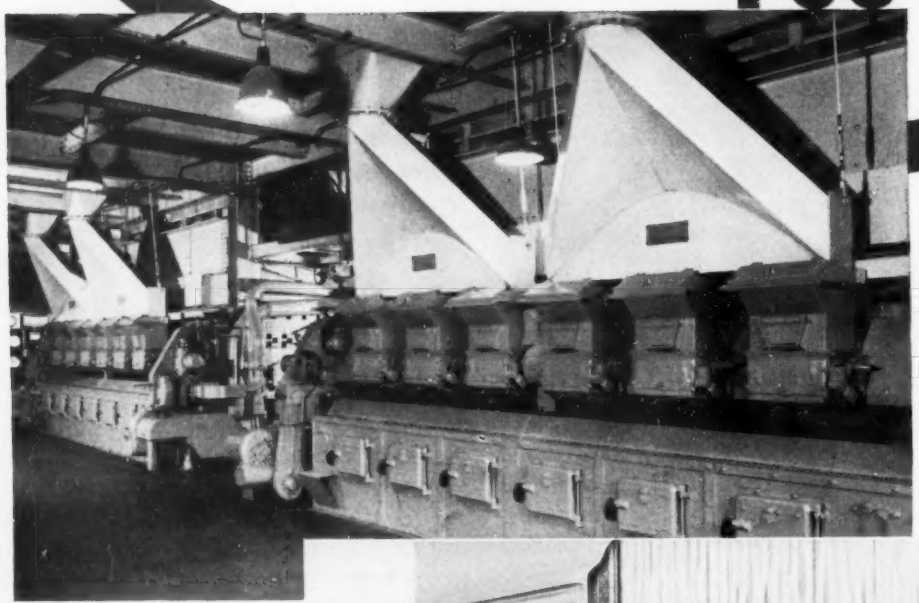
That's why, if you're planning to modernize or build a new plant, it will pay you to get the latest facts on coal. Let a consulting engineer show you how a modern coal installation designed to meet your specific needs can save you real money.

What's more, today, bituminous coal customers get a better-prepared product—designed to meet their special requirements. And coal offers future dependability no other fuel can match. Reserves are virtually inexhaustible, and America's coal industry is the world's most efficient—your assurance of dependable supply at relatively more stable prices for years to come.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

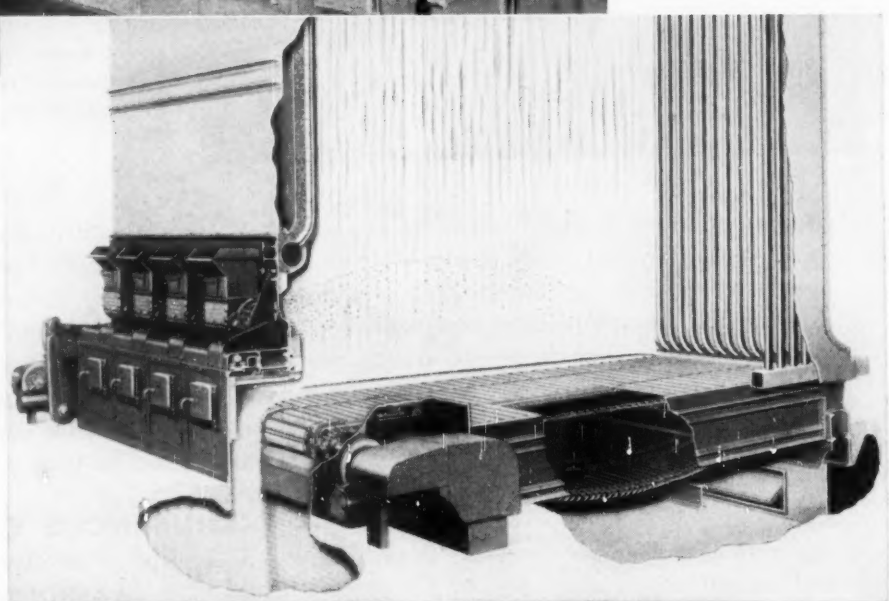
Detroit Rotograte Has You Need



Typical installation of Detroit RotoGrate Stokers in prominent Midwestern Plant. Units designed for capacities of 150,000 pounds of steam per hour each.

Cut-away view of a typical water cooled furnace of a steam generator. Two feeders are removed to show the specially designed overlapping grate that moves slowly forward to continuously discharge the ash at the front. A scientifically designed reinjection system provides effective furnace turbulence.

Detroit RotoGrate Stokers may be applied to all types and makes of boilers or steam generators, and are available for capacities up to 400,000 pounds of steam per hour per unit.



DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

Works at Monroe, Michigan • District Offices in Principal Cities

The Features in a Stoker:

- Burns any Bituminous coal or Lignite.
- Requires no special fuel preparation.
- Exceptional fuel economy.
- Low auxiliary power.
- Increased capacities due to higher burning rates.
- Responsive to fluctuating loads.
- Continuous ash discharge eliminates intermittent cleaning.
- Coal feed, air supply and ash discharge are automatically controlled.
- Air for combustion may be preheated.
- Availability high—Maintenance low.

Hundreds of such RotoGrate installations have been made since first introduced by us in 1938. Repeat order customers are best evidence of satisfactory performance.

Do you need more steam? If so, investigate and order your Detroit Stokers now. Whether you are an old or new customer, we are at your service. Write for catalog.

There is a type and size of Detroit Stoker for every Industrial or Commercial need.

DETROIT ROTOGRATE STOKER

REPRESENTATIVE INDUSTRIAL ROTOGRATE USERS

★Abitibi Power & Paper Co., Ltd.
★Allied Chemical & Dye Corp.
★Amalgamated Sugar Co.
★American Crystal Sugar Co.
American Cyanamid Co.
American Distilling Co.
American Steel Foundries
Campbell Soup Co.
Capitol City Products Co.
Carborundum Co.
★J. I. Case Co.
Certain-teed Products Corp.
Chesapeake & Ohio Railway Co.
Chicago & Northwestern Railway Co.
★Chrysler Corp.
Clinton Industries, Inc.
★Consolidated Paper Co.
★Peter Cooper Corps.
Crane Co.
Crucible Steel Co. of America
Cudahy Bros. Co.
E. I. DuPont de Nemours & Co.
Elliott Co., Inc.
Falk Corp.
★General Electric Co.
★General Motors Corp.
Goodyear Tire & Rubber Co., Inc.
★Great Western Sugar Co.
Hoberg Paper Mills, Inc.
Illinois Central System
Interlake Iron Corp.
Jeffrey Mfg. Co.
Jones & Laughlin Steel Corp.
Kimberly-Clark Corp.
★Libby-Owens Ford Glass Co.
★Eli Lilly & Co.
★Minnesota Mining & Mfg. Co.
★Monsanto Chemical Co.
★Nash-Kelvinator Corp.
★New York Central System
★Northwest Paper Co.
Pabst Brewing Co.
Pacific Mills
★Pullman Standard Car Mfg. Co.
Quaker Oats Co.
Rochester & Pittsburgh Coal Co.
★Rohm & Haas Co.
Schmidt & Ault Paper Co.
★Studebaker Corp.
★Sutherland Paper Co.
Tennessee Coal, Iron & Railroad Co
★Tennessee Eastman Corp.
United States Gypsum Co.
United States Rubber Co.
★Walworth Co., Inc.
Western Electric Co., Inc.
Wilson & Co., Inc.
★Wyman-Gordon Co.
★Repeat Order Plants

Coal Handling and Coal Firing

1 Dries and preheats coal for instant ignition and uniform distribution

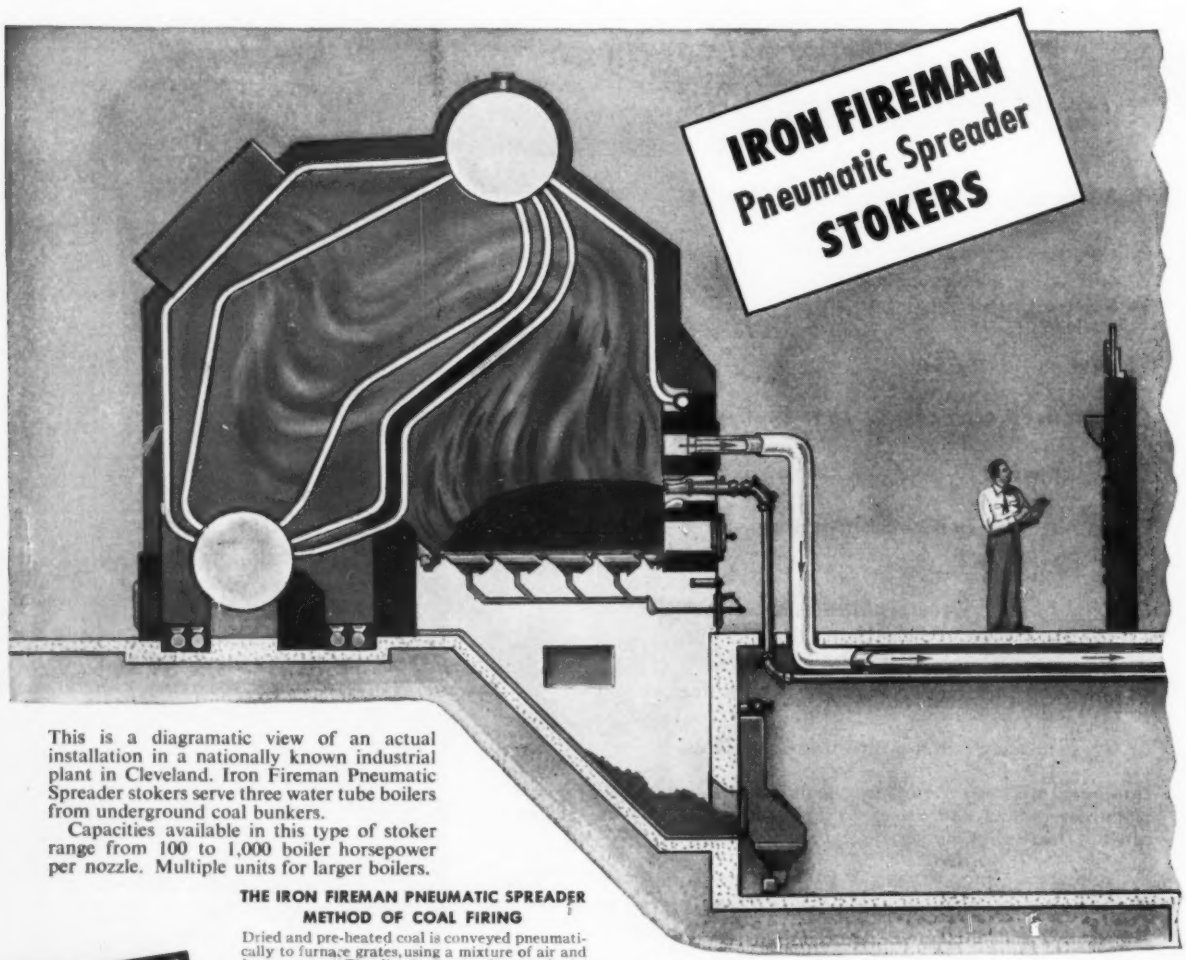
A mixture of air and hot furnace gases is used for drying the coal and conveying it to the furnace grates. When the dry coal reaches the distributor nozzle it is properly conditioned for uniform distribution, and is also preheated to the point where almost instant ignition is assured.

2 Conveys coal automatically. No special handling equipment required

Iron Fireman coal conveying system is an integral part of the stoker. It is extremely flexible in application, permitting coal storage bins to be located in almost any position relative to the boiler. Automatic coal feed from bin to boiler makes other handling equipment unnecessary.

3 Fires coal automatically. Firing rate is always adjusted to steam demand

The firing rate automatically adjusts itself to the boiler load, even with widely fluctuating steam demands. The coal feed rate is capable of infinite variation from low fire to high fire and is therefore ideally suited to modulating combustion control.



This is a diagramatic view of an actual installation in a nationally known industrial plant in Cleveland. Iron Fireman Pneumatic Spreader stokers serve three water tube boilers from underground coal bunkers.

Capacities available in this type of stoker range from 100 to 1,000 boiler horsepower per nozzle. Multiple units for larger boilers.

THE IRON FIREMAN PNEUMATIC SPREADER METHOD OF COAL FIRING

Dried and pre-heated coal is conveyed pneumatically to furnace grates, using a mixture of air and furnace gases. The distributor nozzle spreads the coal over the *entire* grate in a shallow, uniform fuel bed. Pre-heated fines burn in suspension, reducing cinder carry-over and greatly improving combustion efficiency and responsiveness as compared with stokers which do not pre-heat coal.

Send for this booklet. This 16 page booklet, illustrated in full color, contains a full explanation of the Iron Fireman Pneumatic Spreader method of coal firing. It is available upon request from your Iron Fireman dealer or you may write to the factory. Address Iron Fireman Mfg. Co., 3042 W. 106th St., Cleveland 11, Ohio.

OIL, GAS, COAL FIRING FOR

IRON

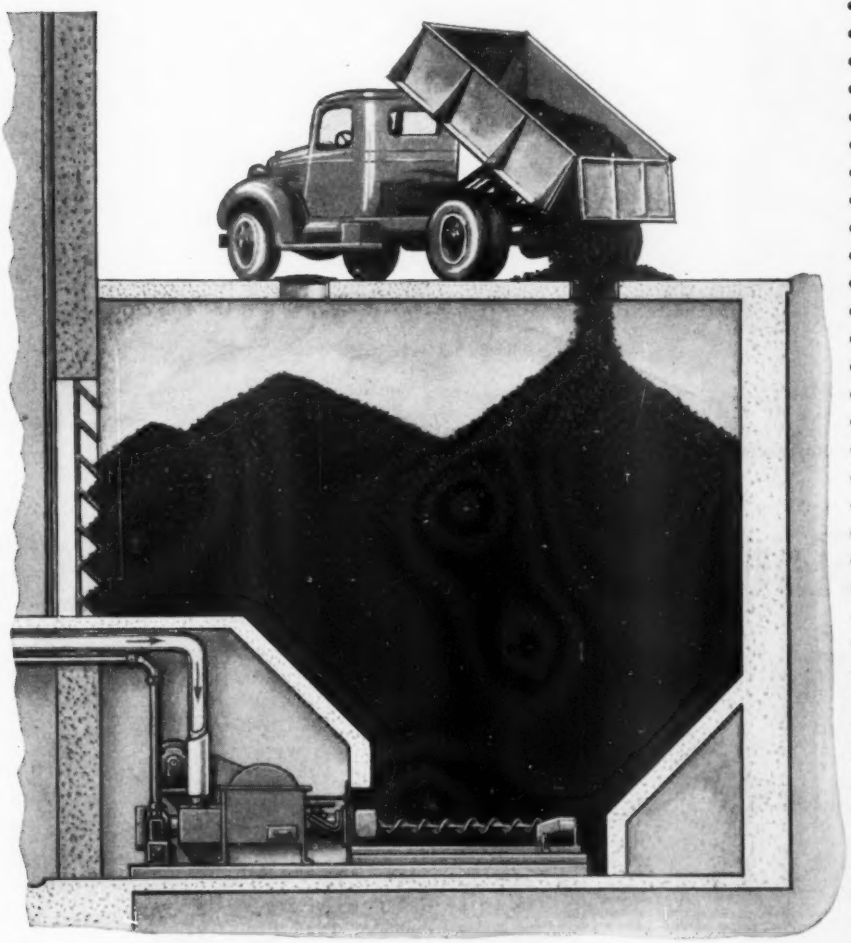
combined in ONE unit

Accurate fuel-air ratio at any firing rate, regardless of fuel bed condition

After efficient air-fuel ratios are determined for the grade of coal being used, these **4** ratios are accurately maintained for all fuel bed conditions. This high degree of precision in automatic control of the fuel and air supply through the entire firing range is one of the important reasons behind Iron Fireman fuel economy.

Burns economy coals efficiently—all grades from ¼" slack to 2" top size

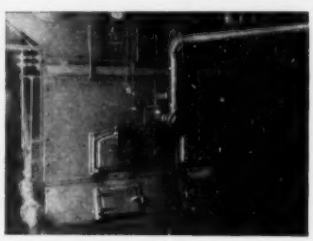
The Iron Fireman Pneumatic Spreader stoker has an outstanding advantage in **5** the wide range of coals that can be used *efficiently*. Since this stoker is not limited to a few special grades, coal can be bought on a most-heat-per-dollar basis, using any coal that has greatest local availability or other advantages.



"We saved 33.9% on fuel alone with Iron Fireman Pneumatic Spreader firing,"

says Mr. H. A. Quinn, Manager Toledo Laundry, Toledo, Ohio

More steam for less money—plus the Iron Fireman Pneumatic Spreader stoker's ability to follow a fluctuating load and eliminate coal handling —has resulted in the installation of 3 units by the owners of this company. Mr. Quinn says, "Since installing Iron Fireman equipment o savings in fuel alone have be 33.9%. For our laundry processi equipment we have increased the temperature from 337°F. to 353°F. with improved quality of production."

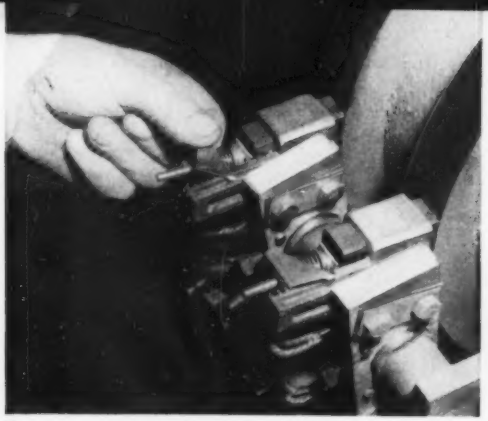


Boiler room at Toledo Laundry.

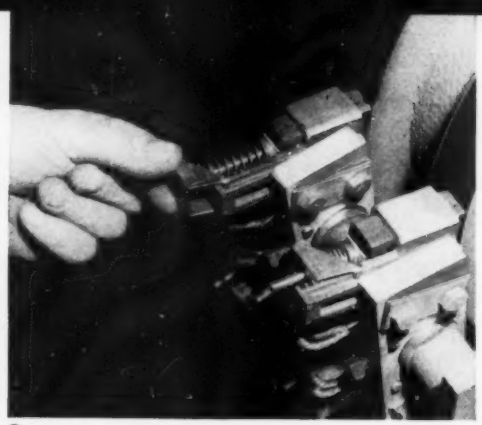
HEATING, PROCESSING, POWER

FIREMAN

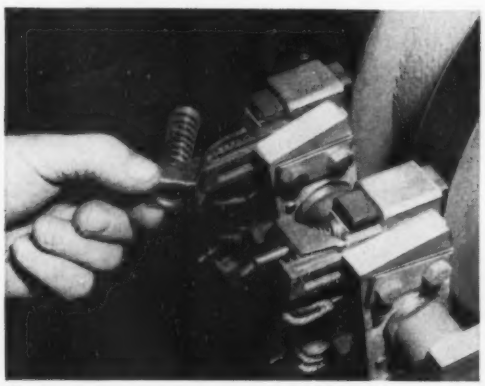
THE IRON FIREMAN



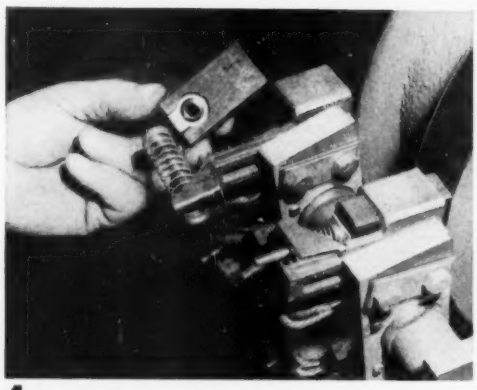
1 To reset brush tension, operator releases spring lock . . .



2 slides it back to relieve pressure . . .



3 and swings locking device to one side . . .

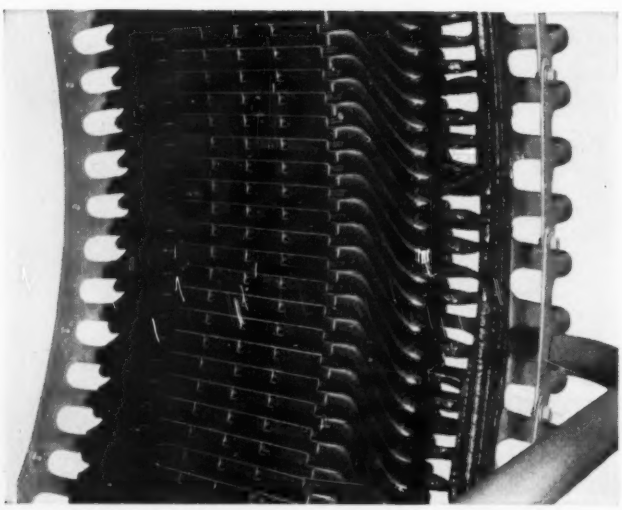


4 for fast and easy brush removal.

BRUSH-PRESSURE ADJUSTMENT, for maximum brush life, and replacement, to assure reliable motor service, are simple matters on G-E synchronous motors. A calibrated spring-loaded brush holder makes resetting brush tension or removal of brushes fast and easy. Brushes are staggered for even brush-ring wear.

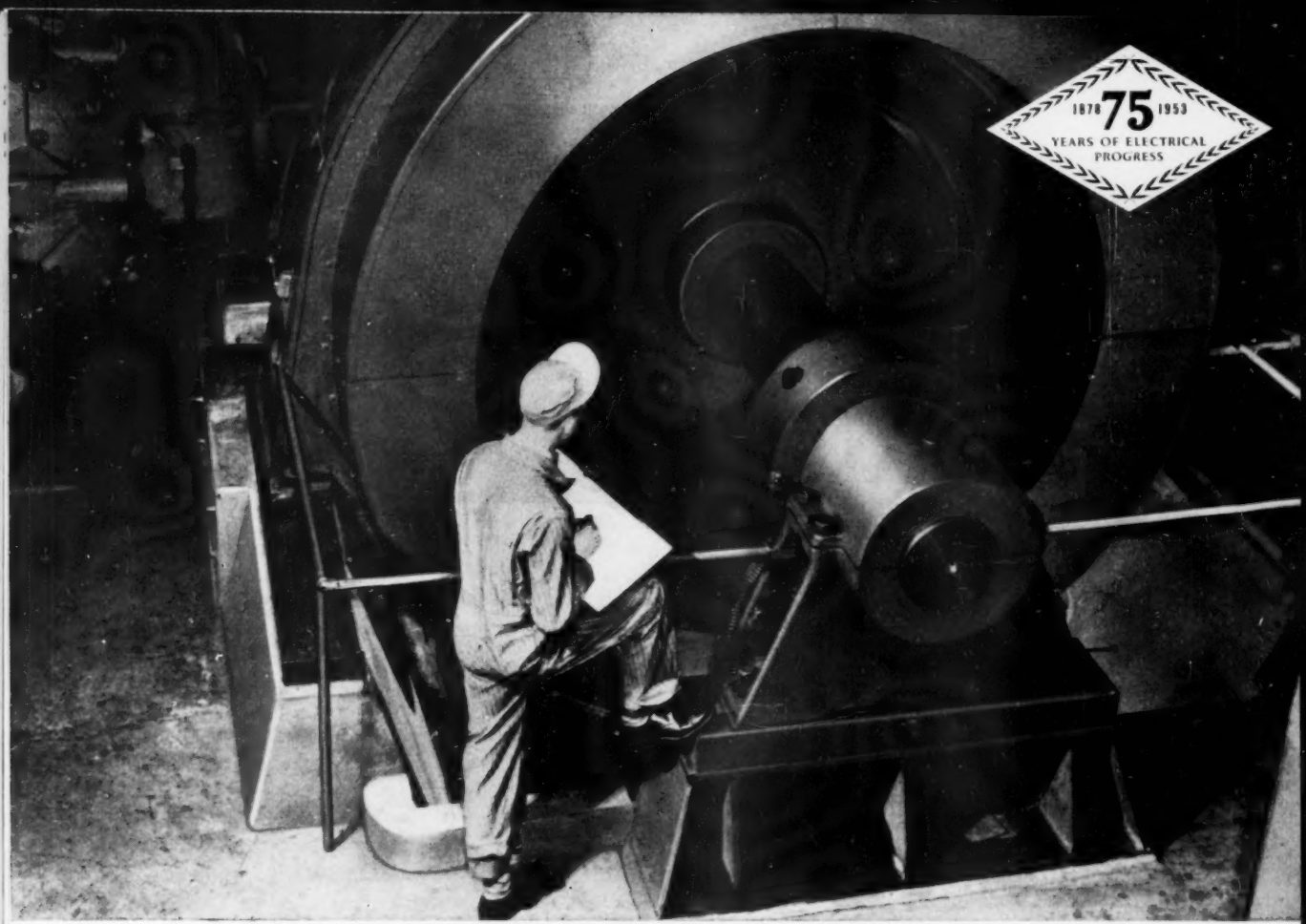
See How Routine Maintenance Is

BEARING LUBRICATION can be readily checked through a large sight-level gage on the bearing pedestal; and when oil is required, handy snap-top covers are provided for easy refilling, as well as oil-ring inspection. A drain plug is conveniently located for quick oil changes.



INSULATION CLEANING is fast on G-E synchronous motors. Windings are coated with a high-gloss Glyptal* varnish that resists the accumulation of dust and can be vacuum or air cleaned in most applications. In extremely dusty or oily atmospheres, deposits can be easily wiped from the windings. Clean windings mean longer insulation and machine life.

*Reg. trademark of General Electric Co.



THIS G-E SYNCHRONOUS MOTOR, RATED 4500 HP, 300 RPM, DRIVES A RECIPROCATING GAS COMPRESSOR.

Easier on G-E Synchronous Motors!

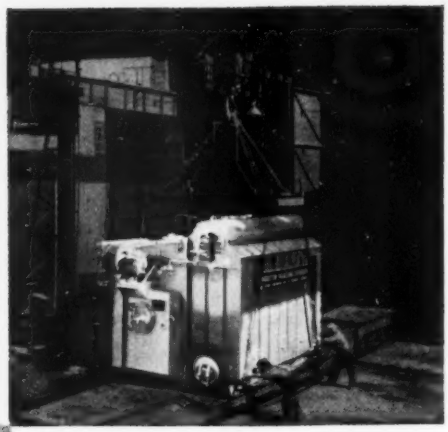
Routine maintenance involves three factors: brushes, lubrication, and insulation. To be sure that these areas are properly serviced, G-E synchronous motors have design features that make checking easy and maintenance fast. Close at hand and easy to adjust, the brush-rigging construction encourages your maintenance men to inspect regularly. Oil-level gage and inspection caps are arranged for quick checking and filling when necessary. The high-gloss insulation on G-E synchronous motor windings resists the adhesion of dust and minimizes the need for cleaning.

These features promote long, reliable motor service and save valuable time for your maintenance crews.

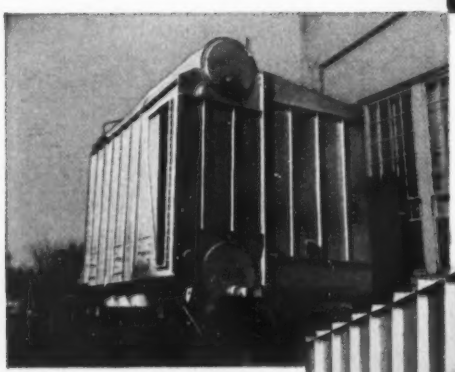
Before selecting your next heavy-duty motor, be sure to consider these important maintenance features. Call in your G-E representative. He will be glad to discuss the many money-saving applications for G-E synchronous motors. Meanwhile, you can obtain more information on G-E synchronous motors by requesting the following publications: GEA-5332, "Low-speed Synchronous Motors" or GEA-5426, "High-speed Synchronous Motors." Write to Section 770-28, General Electric Company, Schenectady 5, N. Y.

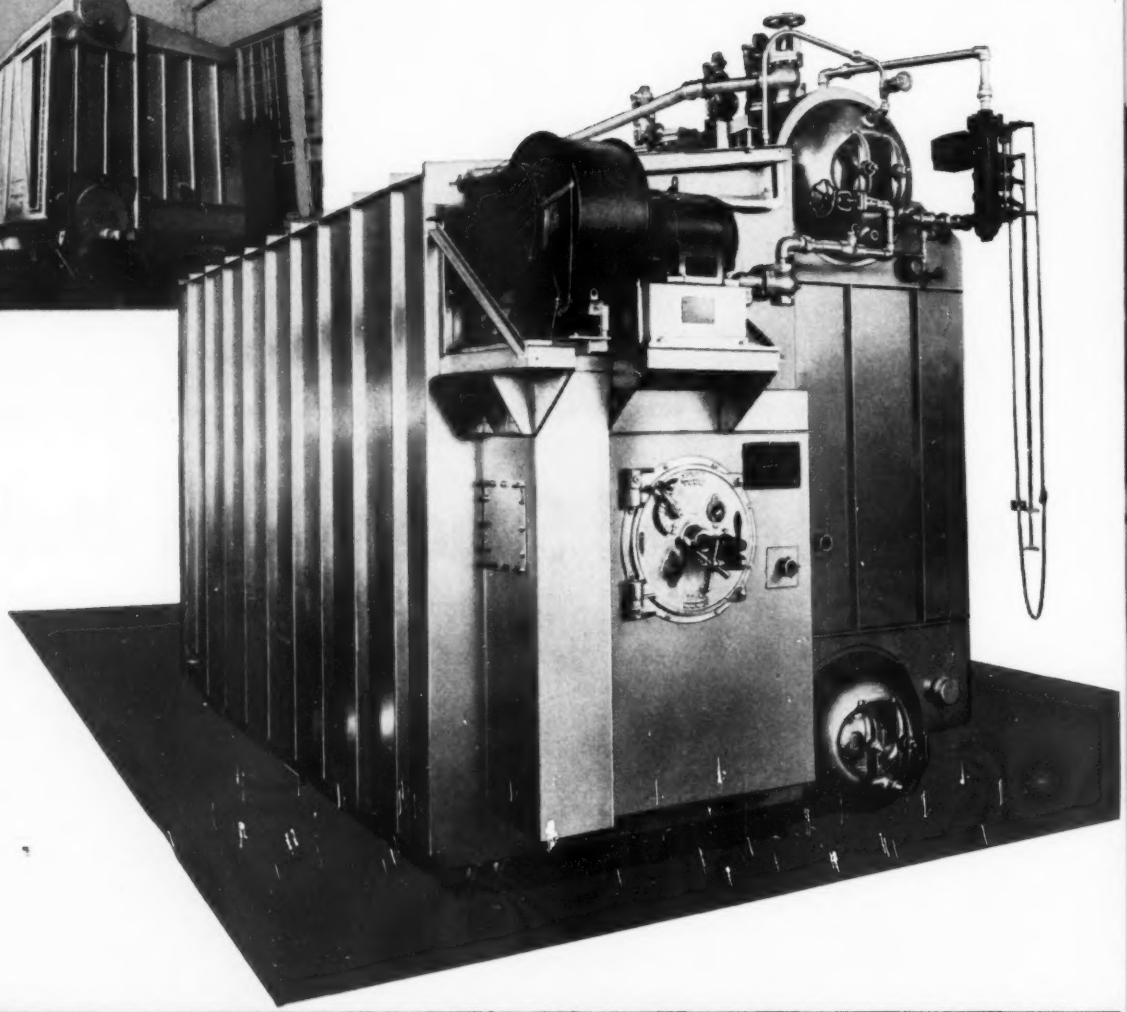
You can put your confidence in—

GENERAL ELECTRIC



the





COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

VP Boiler...

THE PACKAGE BOILER WITH *extra* FEATURES

Most of the water-tube "package" boilers available today look very much alike. As a matter of fact, in some respects they are alike.

The prospective purchaser's job is to discover which of the several package boilers now available offers a combination of features and advantages that adds up to the "best buy".

Consider, then, the fact that the C-E Package Boiler, Type VP, has *all* the design features offered by any of its contemporaries *plus* the following extras—

Fully Water-Cooled Furnace – Even the front or "burner" wall is protected, except in three smallest sizes. Has higher ratio of furnace-wall cooling to furnace volume than any boiler of its size and type. Assures rapid and efficient heat absorption, lower gas temperatures entering convection bank, reduced tendency to slag formation. Minimizes furnace maintenance.

Larger Lower Drum – The large lower drum, 30″ in diameter, permits simple, symmetrical tube arrangement; provides easy access when necessary for washing down or for inspection; greater water storage capacity facilitates handling fluctuating loads.

Centrifugal Fan – This type of fan is more efficient, operates at lower speed and is quiet in operation. The average noise level is less than half that of typical high-speed blowers used on most boilers of this type. Low noise level is particularly advantageous in confined space and in such installations as hospitals.

Simple Baffle Arrangement – Minimum changes in direction (no baffle at all in convection bank in larger size units). Gives lower draft loss. Simplifies soot blowing. Cross-flow of gas with elimination of dead pockets gives maximum heat pick-up. Water-cooled baffle in intermediate sizes ensures minimum maintenance.

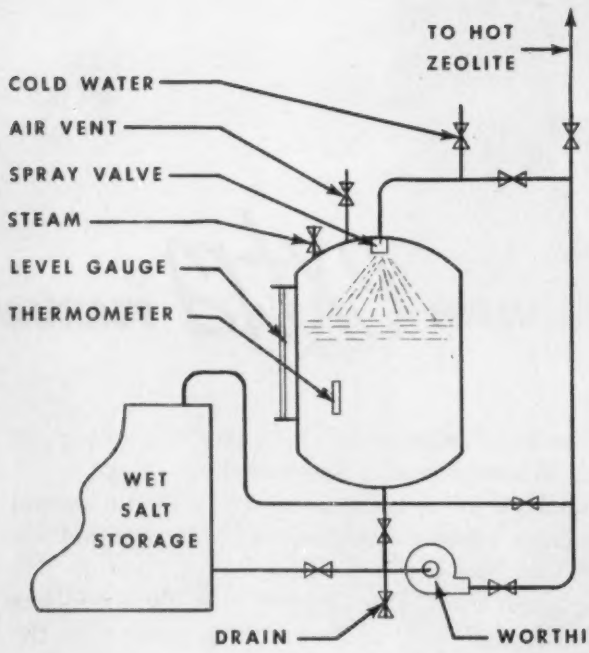
VP Boilers are available in capacities from 4,000 to 30,000 lb of steam per hr; pressures to 250 psi. Send for Bulletin VP-10.

B-652

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E



SEQUENCE OF OPERATION OF WORTHINGTON'S HOT-Z REGENERATING SYSTEM*

1. To initiate service, gradually raise zeolite to operating temperature by regulating steam supply to injection water.
2. Return excess water to wet salt storage or discharge through drain.
3. Fill heater storage with saturated brine to desired level.
4. Recirculate until operating temperature is reached.
5. Deliver measured, heated and deaerated brine to zeolite.
6. Return excess brine to wet storage for resaturation.
7. To cut zeolite out of service, inject fully heated water and gradually reduce temperature by regulating steam supply.

*patent applied for.

MAXIMUM LIFE FROM ZEOLITE

How Worthington's Hot-Z Plant protects Zeolite by maintaining uniform temperature during regeneration

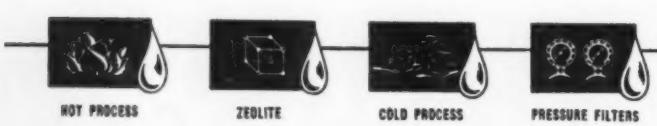
Another feature to check into when you're choosing Hot-Z treating equipment: *the regenerating system.*

For maximum life of the zeolite, two requirements should be met. 1. *A uniform temperature* should be maintained while regenerating the zeolite: that is, the regenerant solution should be held at essentially the same temperature as the water under treatment. 2. When putting a softener into or out of service, the temperature of the zeolite should be raised or lowered *gradually.*

Worthington has accomplished this dual objective with a brine deaerating heater for regenerating the hot zeolite. Its operation is explained in the diagram and accompanying caption. Deaeration is desirable to retard corrosion which might be caused by oxygen in the brine.

This heating system is just one of several exclusive features you'll find in every Worthington Hot-Z system. Remember, too, that Worthington makes all of the major types of water conditioning systems. Let us study your problem and recommend the most suitable solution. Write, stating service conditions in detail, to Worthington Corporation, Water Treating Division, Harrison, N. J.

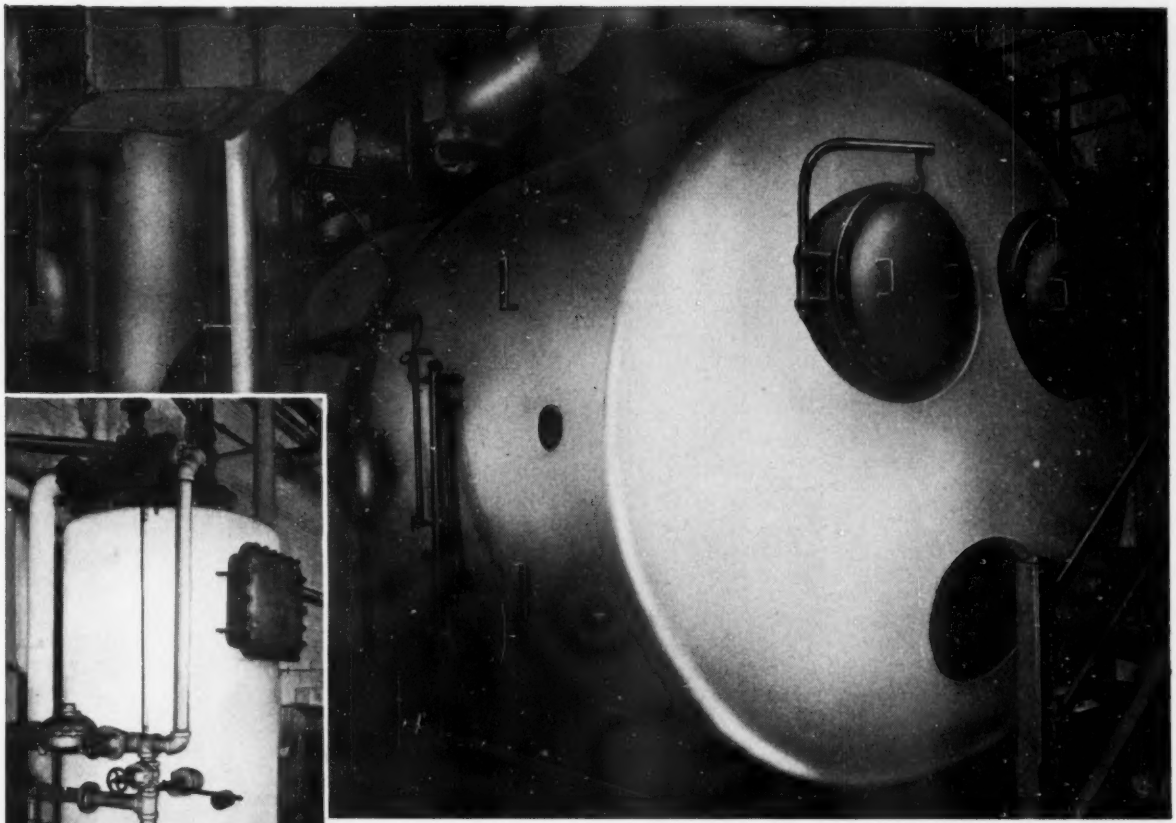
J.2.3



Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning



A Big Help

on small—as well as big—deaeration jobs

Small deaerators are big business at Worthington! That's why the plant with small-capacity requirements will benefit by getting acquainted with the complete range of Worthington deaerating equipment.

Worthington Gives You All Types, All Sizes

Worthington deaerating heaters and deaerators are built in sizes to handle from a few thousand pounds an hour to over a million. They are tailor-made to fit the particular requirements of each job. Special designs are available for operation with scale-forming water.

Both tray and steam-jet types are made—with external surface-type vent condensers or internal direct-contact vent condensing. They can be furnished for any practical operating pressure—constant or variable—or for vacuum operation.

With a complete range of sizes and types at their fingertips, Worthington engineers can competently recommend the design best suited to *your* requirements.

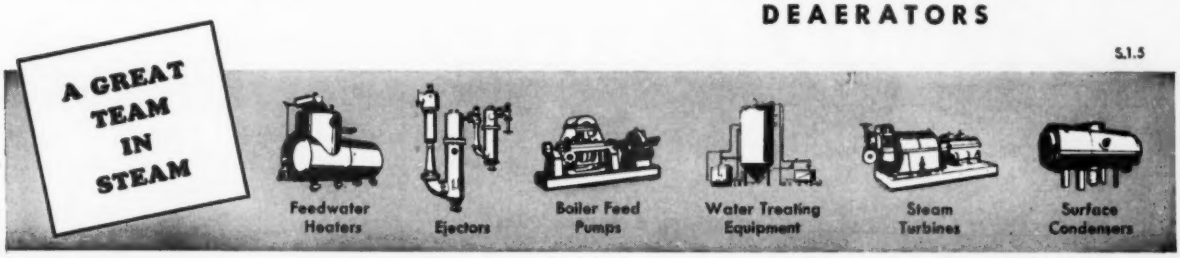
Remember, too, Worthington designs are backed by over 50 years experience in the design and manufacture of direct contact feedwater heaters and over 100 years experience in hydraulic machinery.

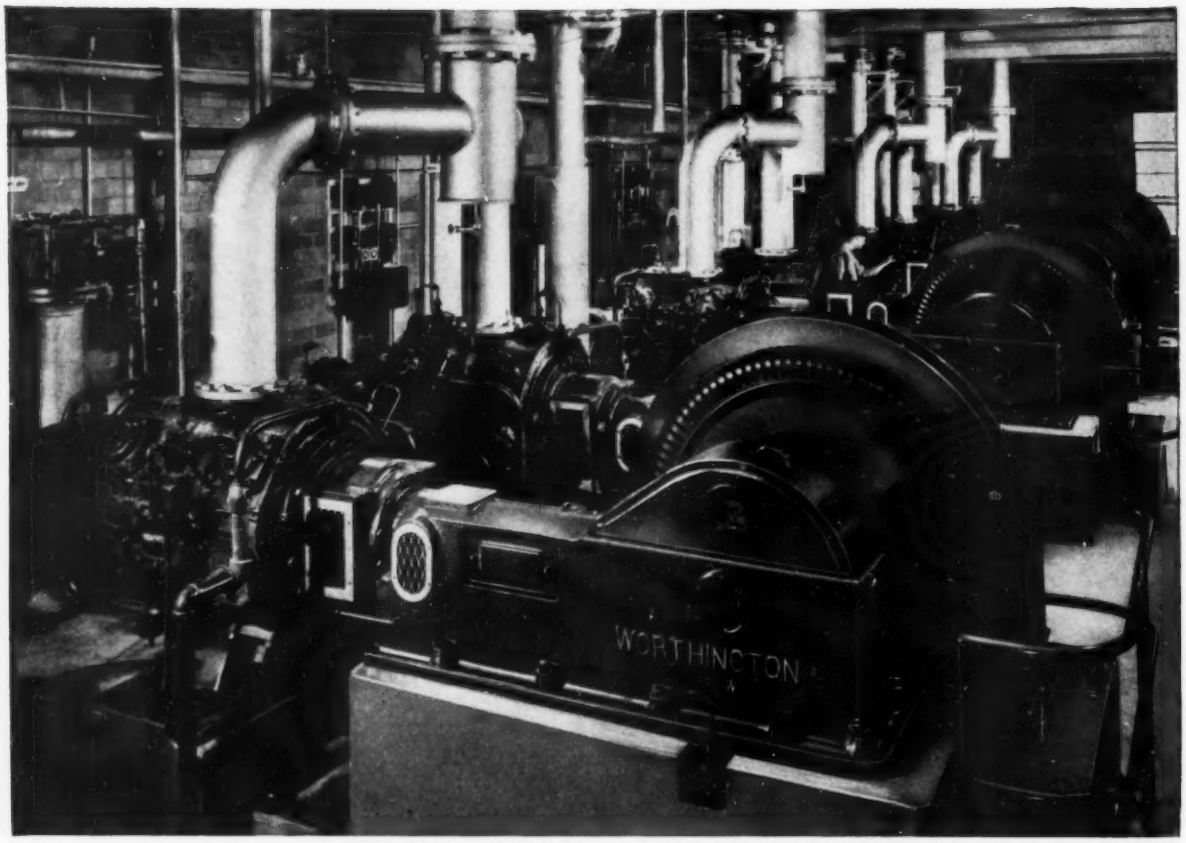
Send your water treating problem to Worthington Corporation, Steam Power Division, Harrison, N. J.

WORTHINGTON

DEAERATORS

S.1.5





AIR IS BLOWN INTO KILNS by these four large Worthington compressors at a Pennsylvania chemical plant. Air pressure must be increased to overcome gradual deposit build-up; when compressor discharge reaches 30 lb. psig, kiln is shut down for cleaning.

Chemical plant gets oil-free compressed air for making important paint ingredient

To manufacture phthalic-anhydride, an essential ingredient in paint, a Pennsylvania chemical company needed compressed air with *no trace* of oil.

Four Worthington *non-lubricated* compressors were specified, and according to the plant managers, they have filled the bill.

Why many plants specify Worthington

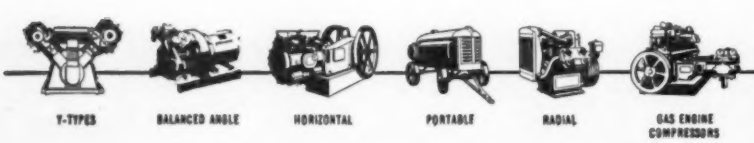
Engineering-wise industrial plants of all kinds are specifying Worthington compressors for reliable, low-cost compressed air. They're getting it because of such Worthington features as:

- *The exclusive Feather* Valve*—simplest, lightest, most efficient valve ever made.
- *High efficiency intercooler*—needing less water, less power, less attention.
- *Automatic variable capacity control*—most accurate and flexible obtainable.

Your engineering problem may call for non-lubricated or lubricated compressors . . . high or low capacity . . . high or low pressure . . . single- or two-stage . . . horizontal or Y type . . . gas or air compression. Whatever it is, for help in solving it write to Worthington Corporation, Compressor Division, Buffalo 5, N. Y.

*Reg. U. S. Pat. Off.

K.2.4

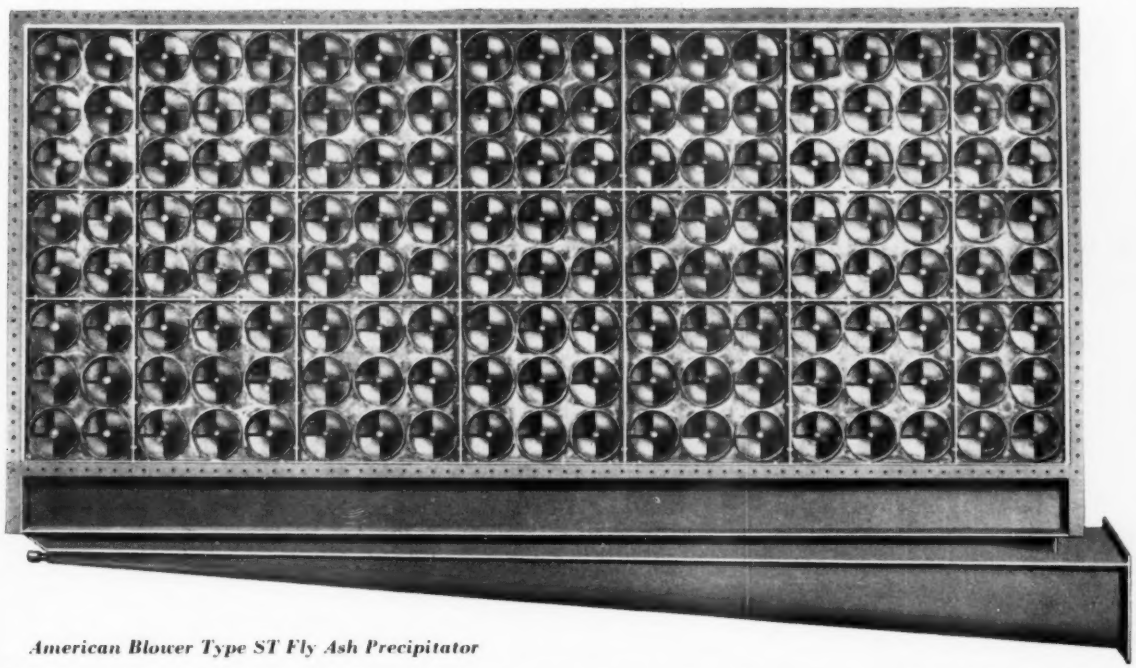


No Other Compressor Will Outperform a Worthington

WORTHINGTON

Compressors

American Blower . . . a time-honored name in air handling



American Blower Type ST Fly Ash Precipitator

Memo to Power Plant Men—

In collecting fly ash from pulverized fuel-fired or stoker-fired boilers you'll have a higher efficiency curve over a wider range of operation if you install American Blower Type ST Fly Ash Precipitators.

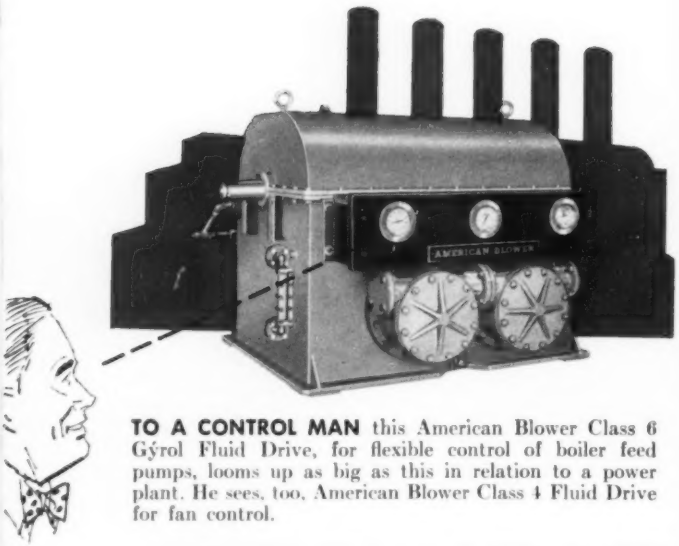
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

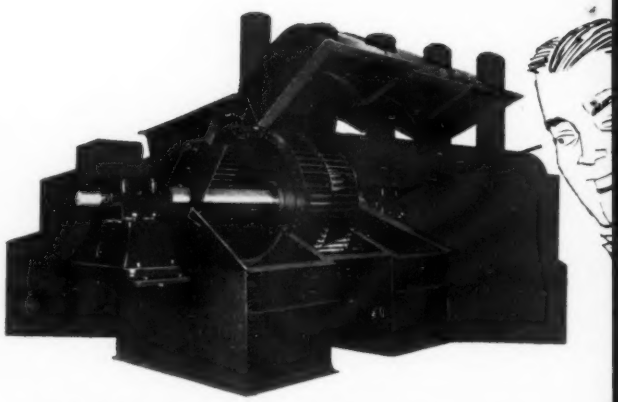
Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER

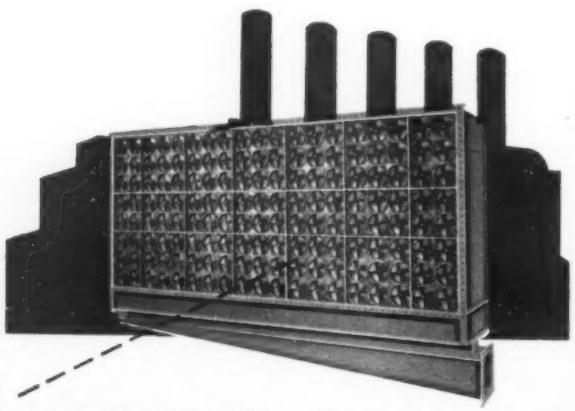
It all depends on how you look at it



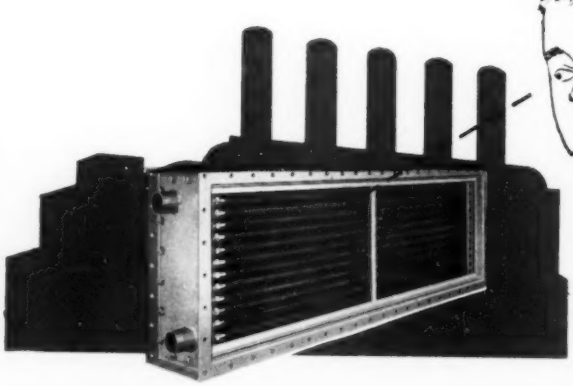
TO A CONTROL MAN this American Blower Class 6 Gyrol Fluid Drive, for flexible control of boiler feed pumps, looms up as big as this in relation to a power plant. He sees, too, American Blower Class 4 Fluid Drive for fan control.



TO A MECHANICAL DRAFT MAN a Sirocco Multi-Blade Fan, which delivers more gas per revolution than any other type, takes *this* proportion in the picture. He could see an American Blower HS Fan equally large if thinking of forced draft.



TO A FLY ASH EXPERT an American Blower Type ST Fly Ash Precipitator looks like this in relation to the rest of the power plant. Little wonder, for the Precipitator lifts a load off his shoulders and minimizes a nuisance.



TO A COIL MAN American Blower Heavy Duty Steam Coils would appear like this in his power plant picture. He likes their great strength, easy accessibility and the way they withstand the high pressures of heavy loads.

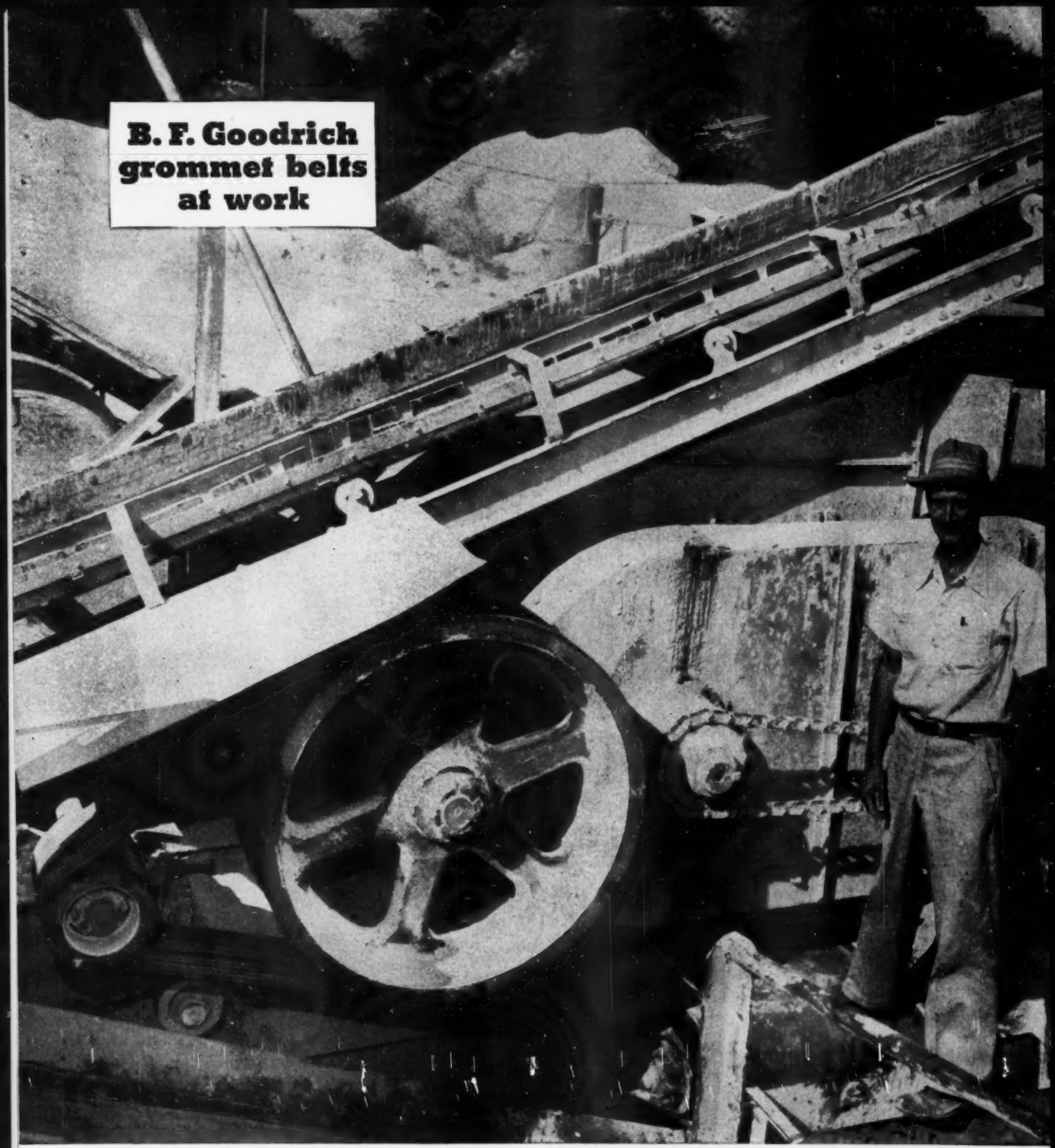
Looking at your complete power plant picture, we believe you'll find, as hundreds of others have, that all these American Blower Products improve over-all power-plant efficiency and insure years of dependable operation. Call our nearest Branch Office for complete data.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER



Crushing chunks of limestone to a fine powder for agricultural lime creates dust so thick and white it looks like snow.

Limestone snow—slippery driving

In this quarry, a series of moving rubber belts, something like a roller coaster, carries limestone from crusher to crusher until the stone is reduced to powder. V belts keep the rubber roller coaster going. But crushing the limestone creates dust, and that mixed with the slightest bit of moisture makes the sheave surfaces so slick that ordinary V belts couldn't grip them. Belts would slip, burn, soon wear out. To find out how this problem was solved, see the following pages.

Limestone snow (continued)

It's slippery driving for belts running in limestone snow at Carthage Marble Corporation, Carthage, Missouri.

A B. F. Goodrich distributor solved the slippage problem described on the preceding page when he installed a set of grommet V belts. Grommet V belts are built to handle heavy loads, yet are more flexible, so they don't slip or stretch as much as ordinary belts. In this case, they put an immediate stop to the slipping, and last 20% longer than the belts used before. Here's why B. F. Goodrich grommet belts outlast and outperform ordinary V belts.

20 to 50% longer life

Grommet V belts, made only by B. F. Goodrich, represent the only basic improvement since invention of the

V belt. Belts last 20 to 50% longer, depending on the service. (The more severe the service the greater the increase over ordinary belts.)

What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

In ordinary belts under high tension the center cords "dish" and tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Each grommet and every part of a grommet carries its share of the load. Grommet V belts have no center cords—therefore much more strength in proportion to cord volume.

Better grip, less slip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They cost no more

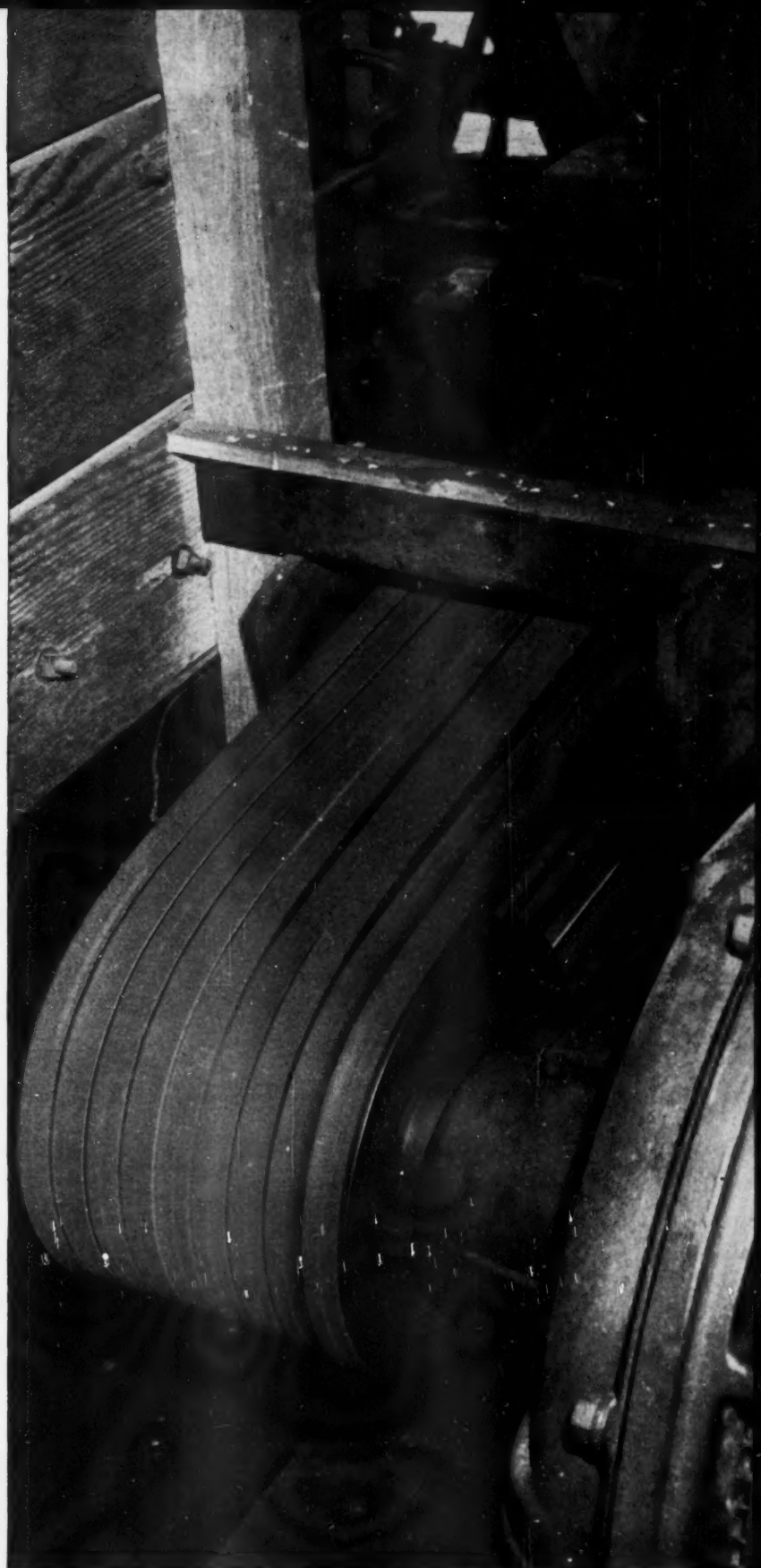
You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. Only B. F. Goodrich makes the grommet V belt.

See "X-ray" Belt

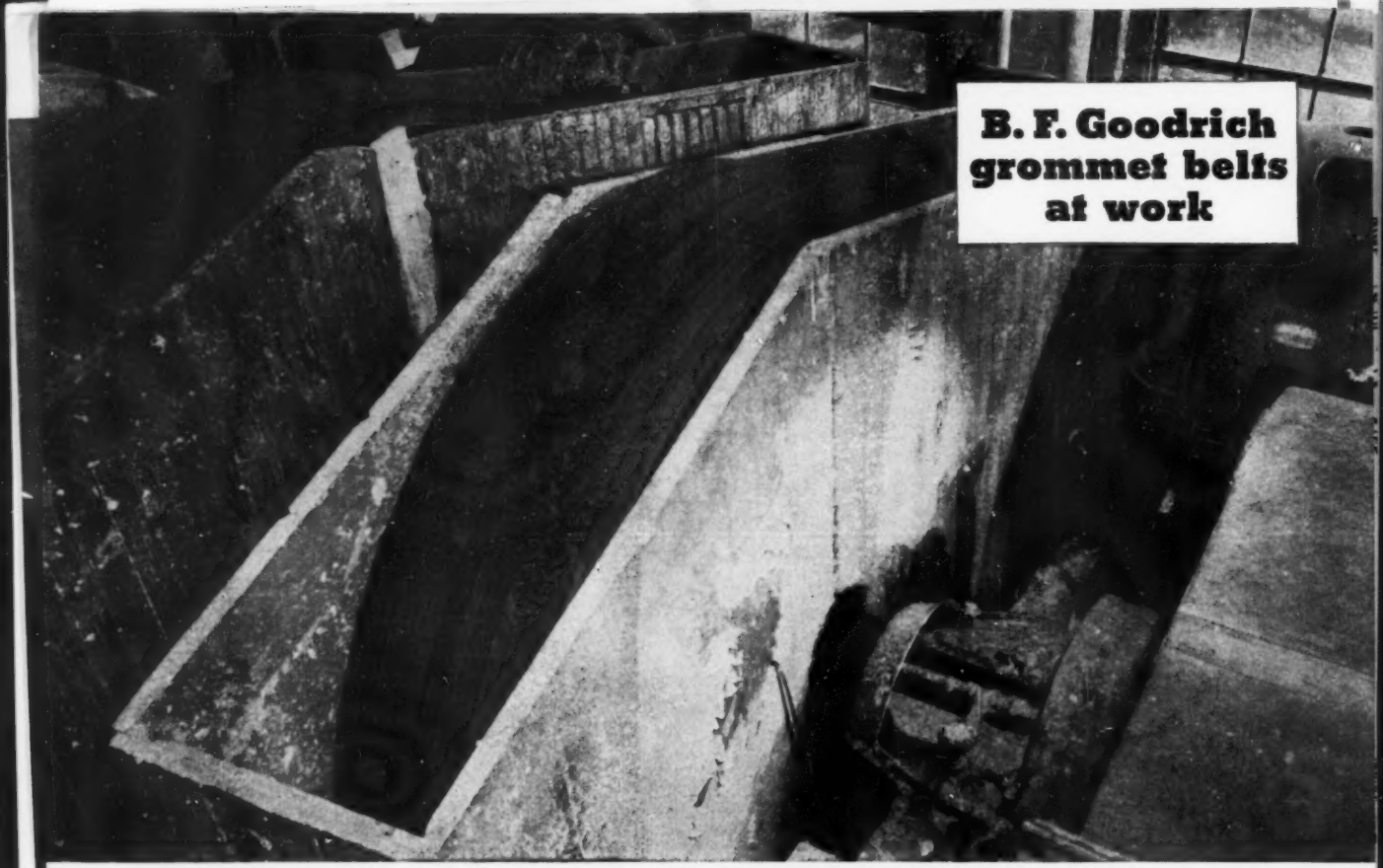
A special demonstrator "X-ray" belt has been made to show the grommet construction. Ask your local B. F. Goodrich distributor to show it to you.

Space savers

These belts run a sand pump on a barge. Flat belts, previously used, were lasting only 12 months, replacement costs were high, and the drive took too much space. Then a B. F. Goodrich distributor suggested a switch to grommet V belts. The changeover not only saved valuable space, but also cut belt costs as the grommet V belts have already run 36 months, and are still going strong.



Belt service tripled when they switched to grommet V belts.



V belt failures used to cause plant shutdowns, slow up production at Westfield Paper Co., Russell, Mass.

Eliminate paper waif

Ordinary V belts on these drives lasted only a year. They couldn't take the 24-hour service, the heavy load running the pulp beaters. Covers would separate from the belt, flap around the drive, get caught in pulleys, finally tear off completely.

A BFG distributor heard of the trouble and recommended grommet V belts. It proved to be a perfect solution. Installed in 1941, both sets of grommet V belts have already outlasted other belts by *10 years*, and still look good for years' more service.

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts—prove they last 20 to 50% longer—yet cost no more.

The B. F. Goodrich Company
Department PO
Akron, Ohio

☐ Please have a BFG distributor call on me to discuss grommet V belts.

☐ Send set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others.

Name_____

Title_____

Firm Name_____

Address_____

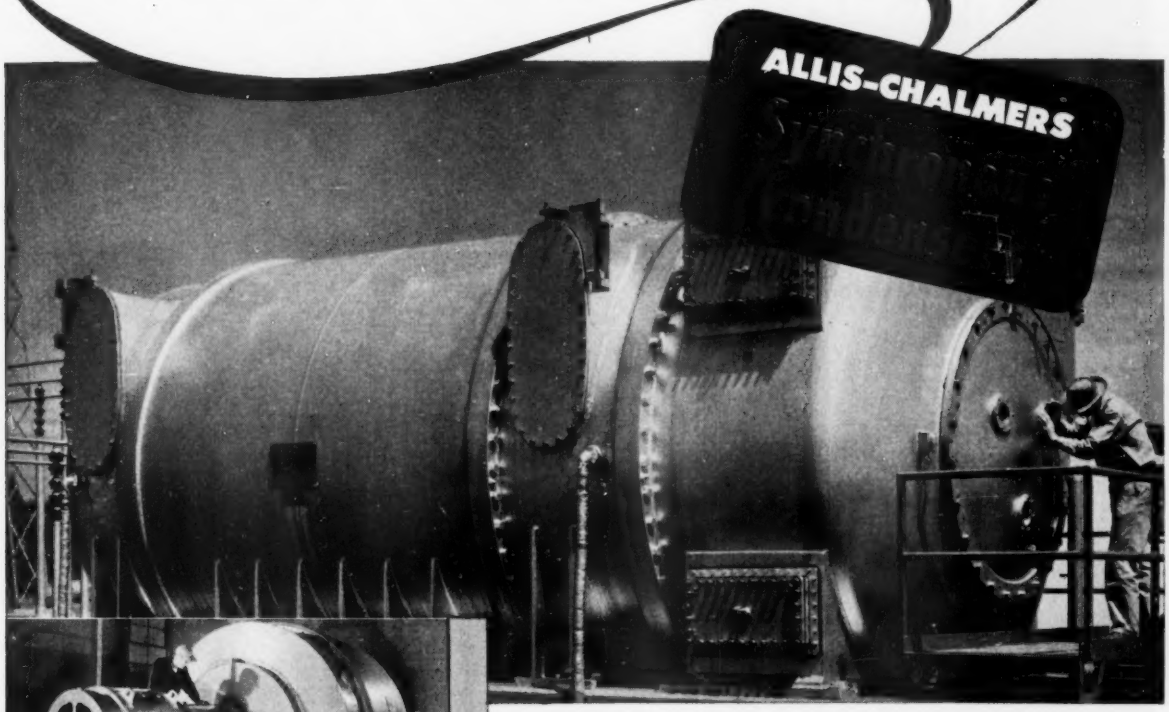
City_____ State_____

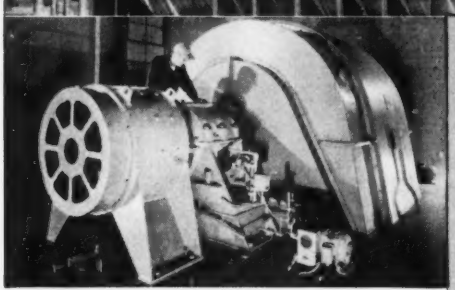
Grommet V Belts BY

B.F.Goodrich

FIRST IN RUBBER

Better than Rebuilding Transmission Lines





Pacific Coast system uses 50,000-kva hydrogen-cooled condenser (top view), and 20,000-kva air-cooled unit (bottom view).

Besides minimizing losses, hydrogen cooling results in a design suited to outdoor operation. Air-cooled units can also be built for outdoor use, and for industrial power-factor-correction applications.

Regulex amplifier control, which acts as both regulator and pilot exciter, is available for all synchronous condenser ratings.

Regulex is an Allis-Chalmers trademark.

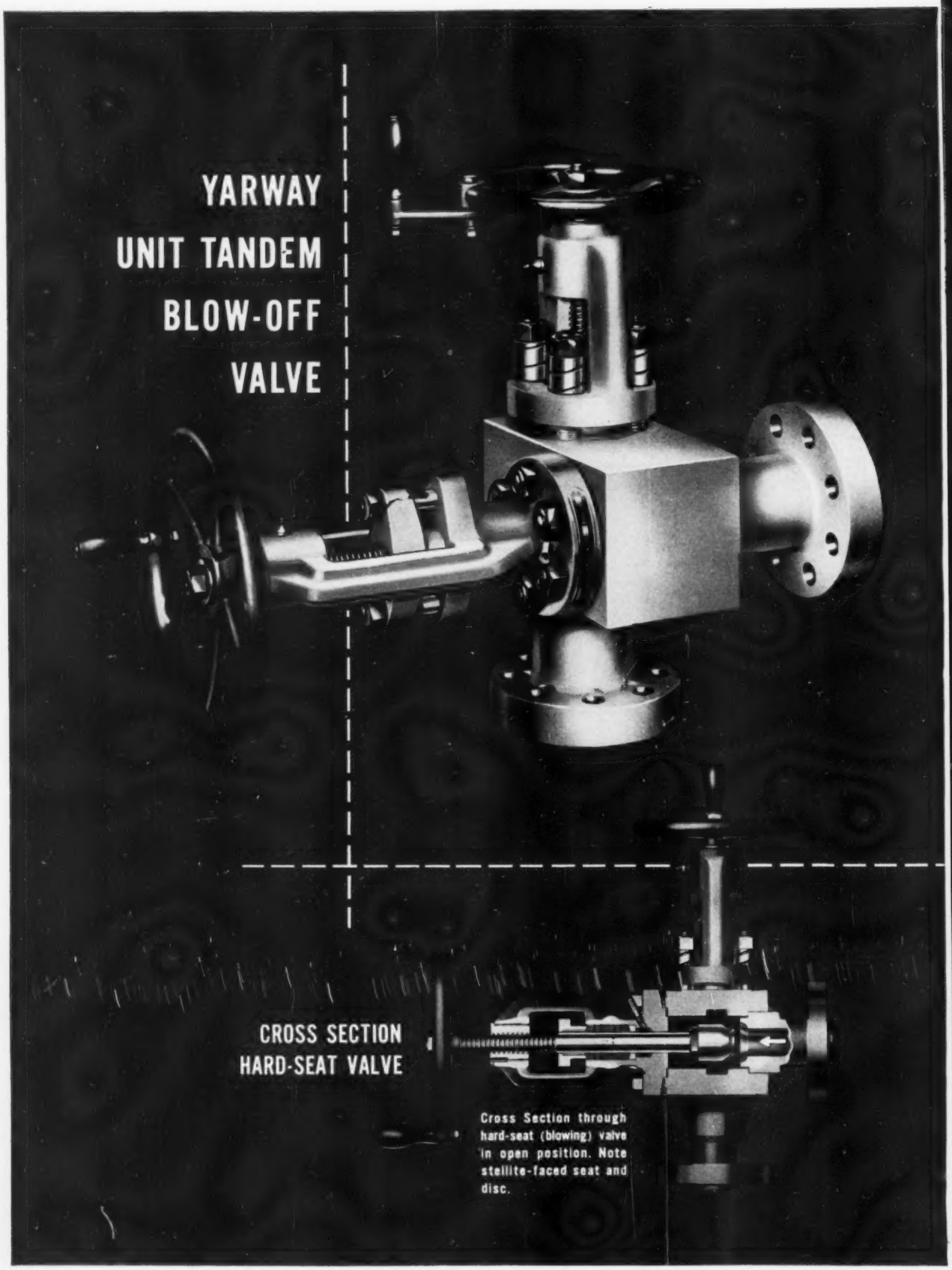
FOR WIDESPREAD power systems, synchronous condensers can frequently be used in place of added or larger transmission lines. This is possible because, by supplying reactive kva, they assure efficient use of power lines.

But condensers can do more than just cut conductor requirements. They also provide voltage regulation on a wholesale scale, and furnish rotating inertia for improved system stability.

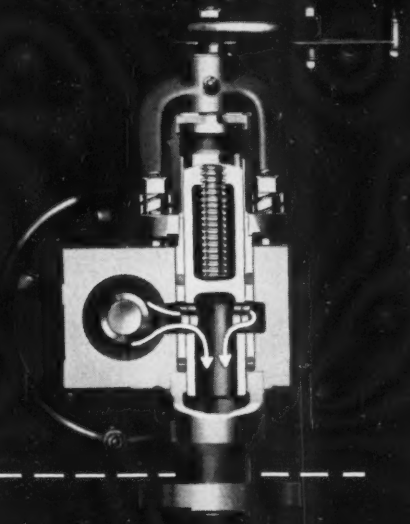
Custom-engineered to fill system requirements and to fit installation conditions, Allis-Chalmers synchronous condensers can help you hold down transmission costs. For more information on units for utility or industrial applications, call in your A-C representative, or write for Bulletin 05B7285. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3960

ALLIS-CHALMERS


YARWAY
UNIT TANDEM
BLOW-OFF
VALVE
CROSS SECTION
HARD-SEAT VALVE
Cross Section through hard-seat (blowing) valve in open position. Note stellite-faced seat and disc.

CROSS SECTION
SEATLESS VALVE



Cross Section through seatless (sealing) valve in open position. (On pressures over 1500 psi two hard seat valves are recommended.)

RUGGEDNESS
...WHERE YOU NEED IT

A one-piece forged steel block serves as the common body for both valves in Yarway Unit Tandem Blow-Off Valves.

You get rugged strength where you need it... added protection for your high pressure boilers.

Whether in times of emergency, normal blowdown service, or acid washing, this high safety factor is a source of satisfaction to boiler plant operators.

Yarway Unit Tandems combine all advancements of modern metallurgy with experienced design and skilled workmanship. The result—DEPENDABLE PROTECTION.

POSITIVE ACTION
...WHEN YOU NEED IT

When putting high pressure boilers on the line, or in times of emergency, you need positive action at the blow-off valves.

With Yarways you have it.

Both the hard seat-seatless combinations and the hard seat-hard seat combinations provide positive opening and closing with drop-tight shut-off. Open yokes permit visual indication of the disc position in the hard seat valve and of the plunger in the seatless valve.

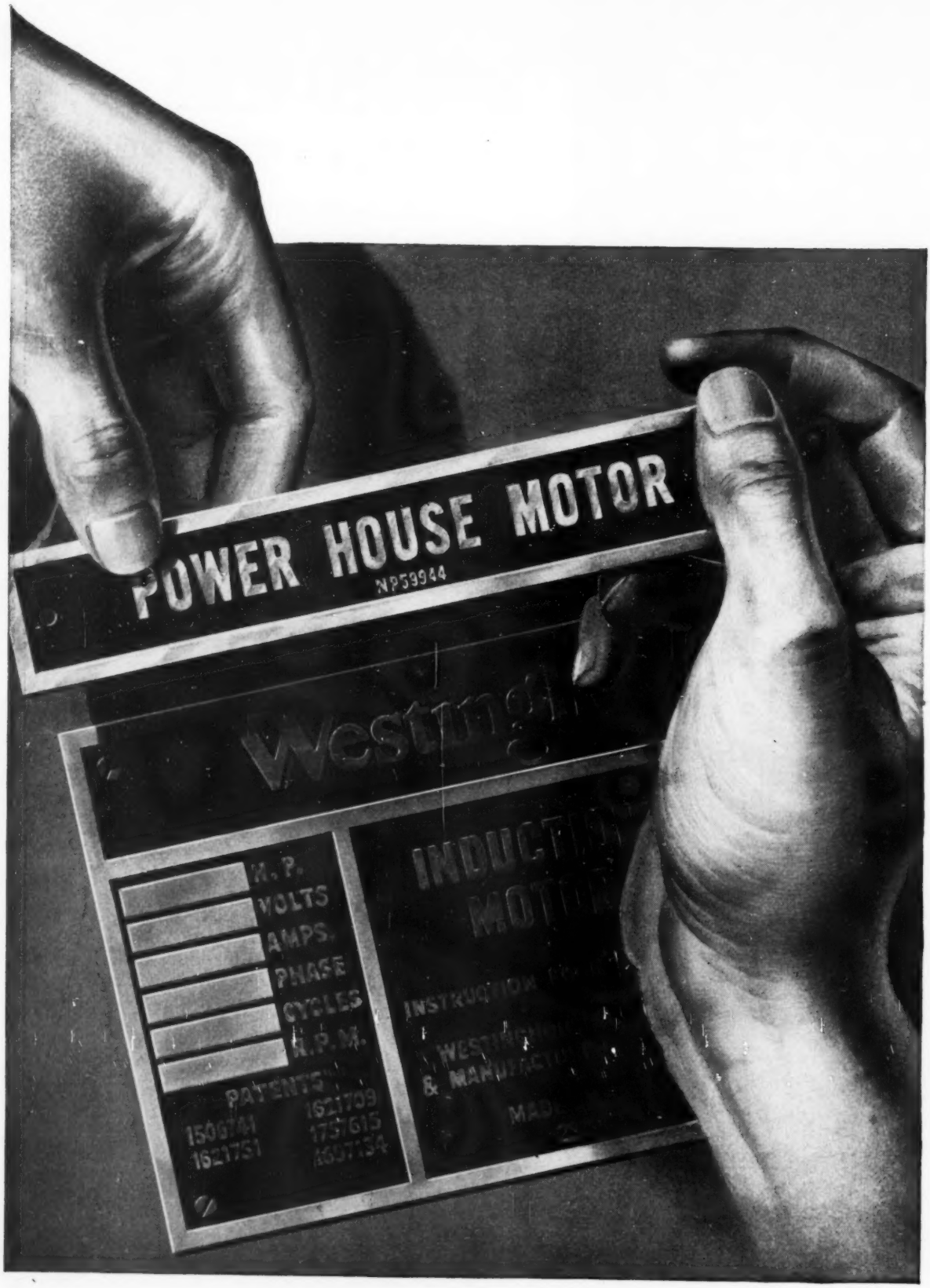
These are some of the reasons why *more than 4 out of every 5 high pressure plants in the United States are Yarway-equipped . . . and* among boiler plants of all pressures, *more than 16,000 are Yarway-equipped.*

Write for your free copy of Yarway Blow-Off Valve Bulletin B-425 (pressures to 400 psi) or Bulletin B-433 (pressures to 2500 psi).

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY®

blow-off valves


POWER HOUSE MOTOR
H.P.
VOLTS
AMPS.
PHASE
CYCLES
R.P.M.
PATENTS

What this Westinghouse name plate means to you

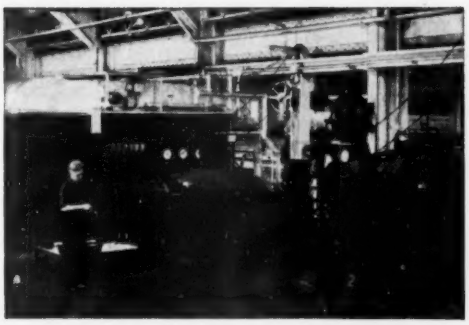
When you see this name plate you are looking at a symbol of motor craftsmanship applied to the complete line of Westinghouse Power House Motors ranging from 1 to 3000 hp. Each of these motors are specially built to meet power station conditions. They are given extra protection and special inspection to assure longer life.

Westinghouse engineers analyze the requirements of each power station auxiliary before the motor is specified. Then a special order is written outlining the design and construction details needed for each motor. As the motor is built, the component parts are tested for highest quality workmanship.

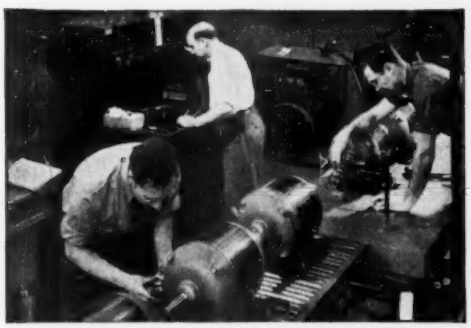
For fullest protection, two extra dip-and-bake varnish treatments are specified for the windings of all Power House Motors except those that are totally enclosed. This special thermoset varnish gives a hard, dirt and grease-repelling finish to stand up to power house conditions.

The best way to know the Westinghouse Power House Motor line is to inspect nearby installations. Call your Westinghouse representative for the location of an installation near you, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21719

YOU CAN BE SURE...IF IT'S Westinghouse



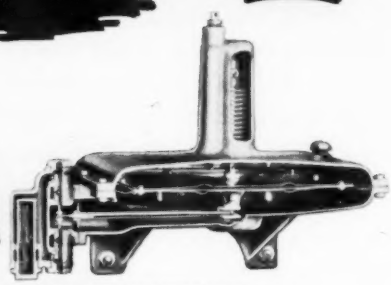
Windings receive two extra dip-and-bake treatments in special varnish for full protection against dirt and grease.



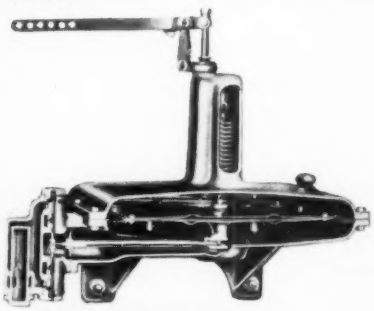
After assembly, each Power House Motor is given a four-hour operating test and complete inspection by the Quality Control Department.

Air-gap check is part of the final inspection given each Power House Motor. Split-shell bearings and bearing housing make inspection easier.

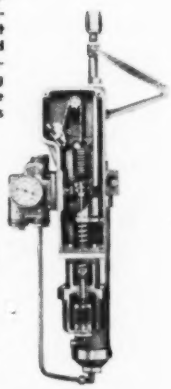
CASH STANDARD
AUTOMATIC COMBUSTION CONTROL SYSTEMS



FURNACE DRAFT CONTROLLER
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



AIR FLOW CONTROLLER
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



FUEL FEED CONTROLLER
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

To inaugurate and maintain a fuel saving program yet produce sufficient steam, whether you use coal, oil, or gas requires the utmost in skilled attendance. There can be no error—no neglect—no sleeping on the job.

To install CASH STANDARD Automatic Combustion Control Systems is like adding "skilled hands" . . . but, with this control you get constant automatic attention to insure correct fuel feed, proper air supply, and a constant over-fire draft . . . there's never a slip . . . therefore, you very easily boost boiler output.

CASH STANDARD Units can be combined to make a most accurate and dependable Automatic Combustion Control System to meet any condition and work on any boiler with any kind of fuel.

Write today for Bulletin No. 300

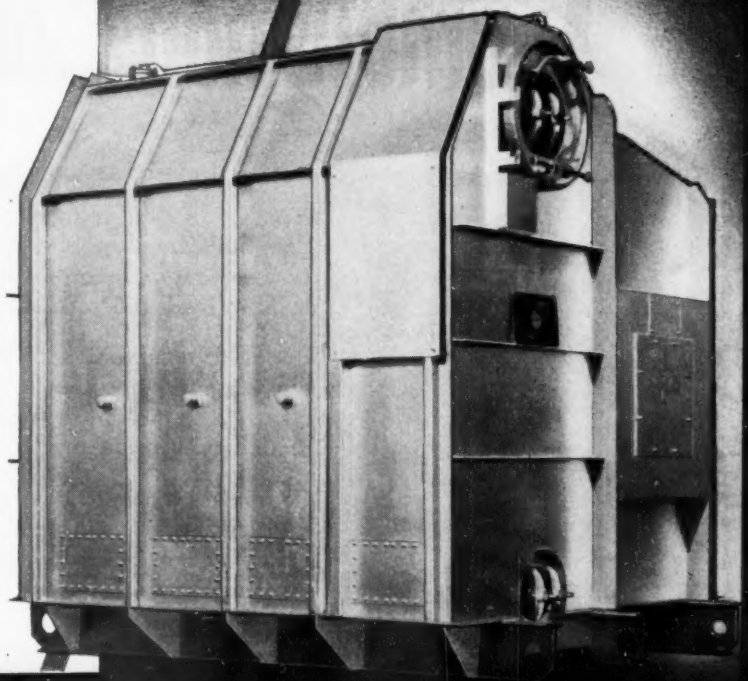
A. W. CASH COMPANY
DECATUR, ILLINOIS

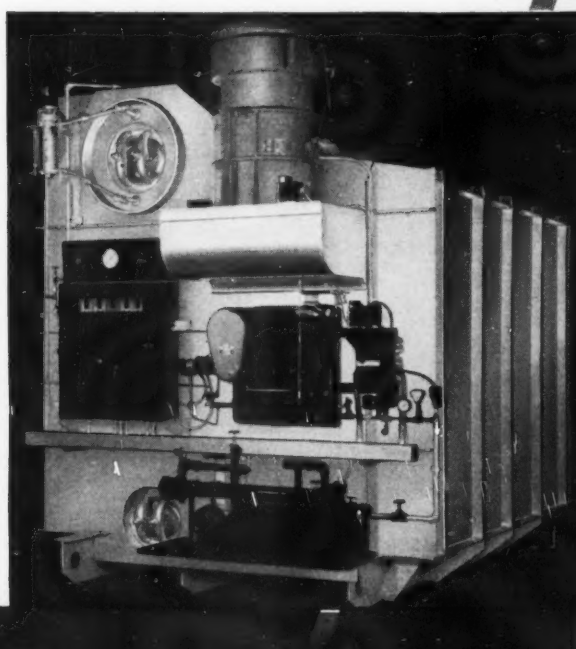
CASH STANDARD
CONTROLS . . VALVES

"PACKAGED POWER!"

SPRINGFIELD
PACKAGE TYPE BOILERS

HERE is Springfield's new Package Type Boiler designed especially to meet many of today's requirements for steam and high temperature hot water in industry, power, and government projects. This new line has had the benefit of more than five years of field testing and development work. Boilers are now available in a range of sizes from 7,500 to 30,000 lbs. of steam per hour, or equivalent water ratings in B.T.U., and in design pressures of 200, 300, 600, and 900 psig. These units combine all the advantages of compact, standardized, portable package boilers with the high efficiency and rugged reliability of Springfield's water tube design. ***Let us give you complete information now.***





FOUNDED SPRINGFIELD BOILERS IN 1890

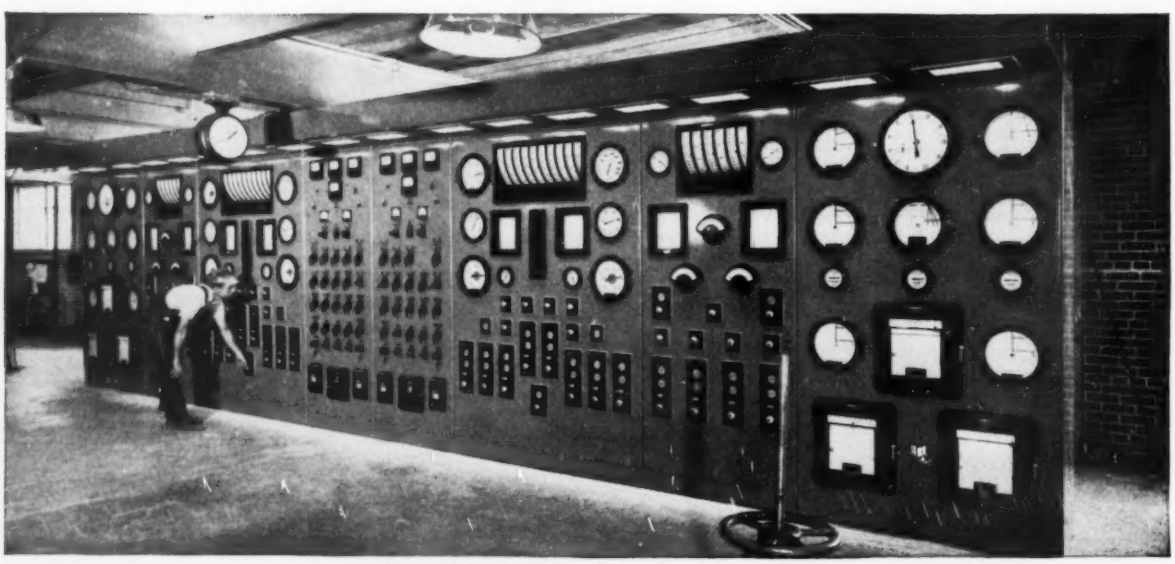
Built to Springfield Standard of Quality

REPUBLIC
Combustion Control Systems

AN automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over a long period at test efficiencies regardless of variations in fuel, load and other operating factors.

Republic combustion control is a unified system controlling the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

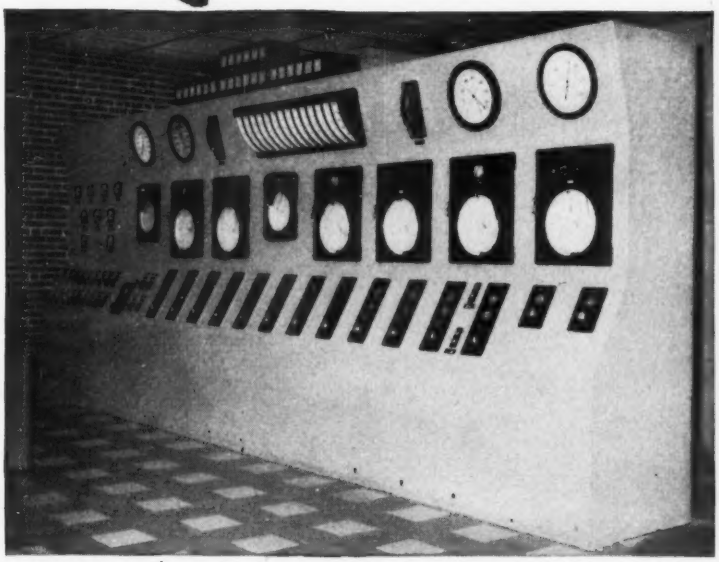
Republic automatic combustion control systems, either pneumatic or hydraulic, are available for all sizes of boilers, all types of fuel firing, and load conditions and any arrangement of draft equipment. They are completely described in Data Book No. S-21—write for your copy.



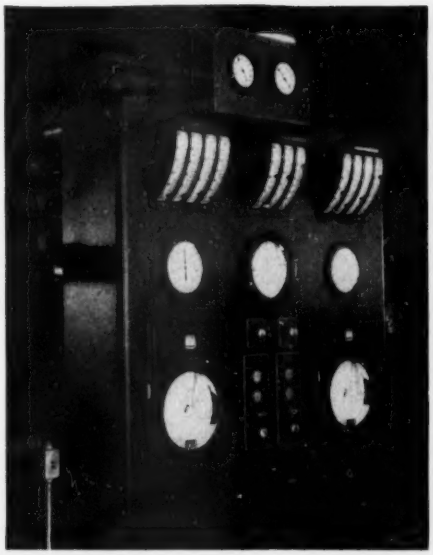
PULVERIZED COAL
In this modern central station steam is generated in two 600,000 lbs. per hr. pulverized coal fired boilers operated by a Republic Combustion Control System.

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

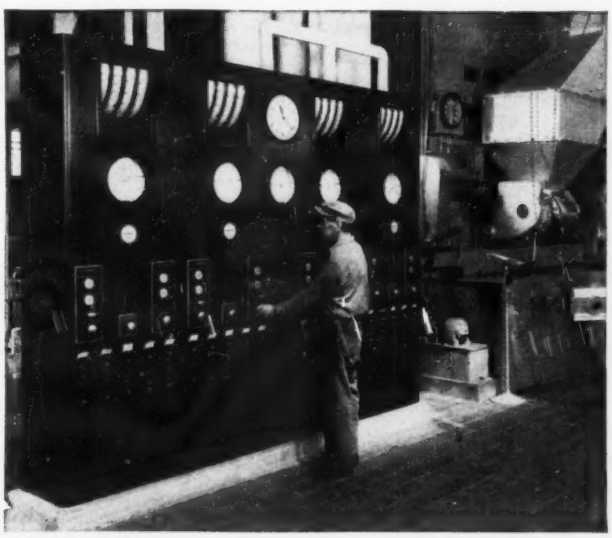
for { ***All Sizes of Boilers***
All Types of Firing
All Arrangements of Draft
All Load Conditions



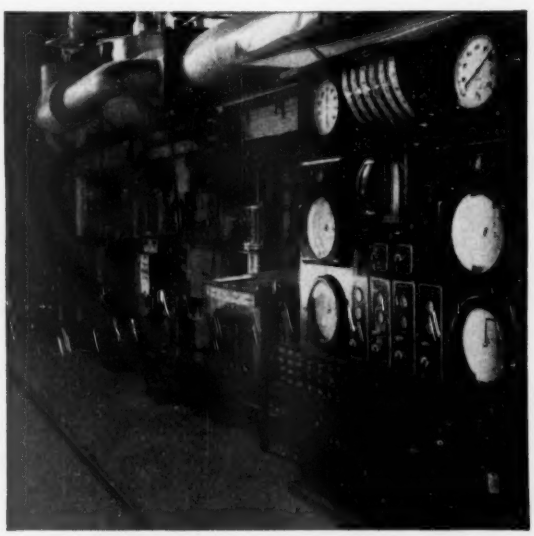
OIL FIRED
A typical Republic automatic boiler control and instrument installation in a large central station for the operation of a 450,000 lb. per hr. oil fired boiler.



MIXED GAS
Republic instrument and controls for two 50,000 lb. per hr. boilers burning mixed gas.



STOKER FIRED
The Republic combustion control and instrument panel for the automatic operation of four 80,000 lb. per hr. stoker fired boilers.



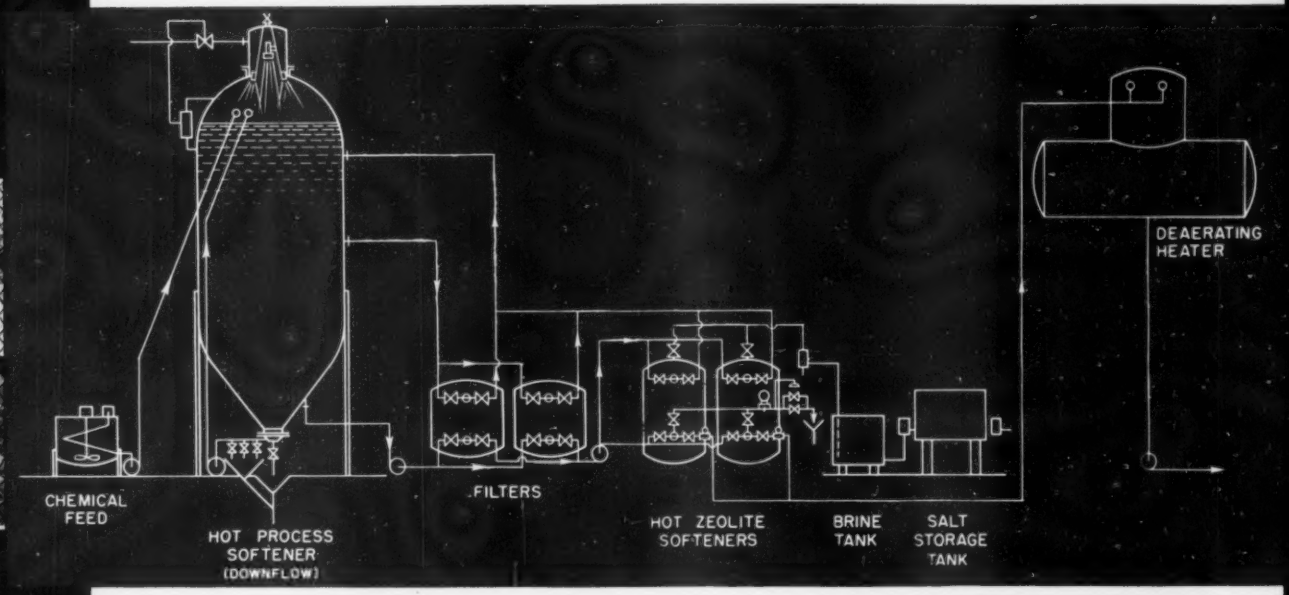
STOKER FIRED
In this modern industrial plant steam is generated in a 175,000 lb. per hr. stoker fired boiler operated by a Republic control system.

"We need an unbiased water conditioning recommendation. Let's get a proposal from

cochrane

Whether your water conditioning problem is simple or complex, call on Cochrane. Our *full range* of water conditioning equipment assures you *unbiased recommendations* and freedom from makeshift methods.

Cochrane recommendations are based on 90 years of specialized experience in water treatment. And those recommendations are without bias or prejudice—because Cochrane designs and builds *every kind and type* of industrial water treating equipment."—From Cochrane you get the plan and the products to give you water of the quantity and quality you want—with greatest economy. Before you decide on any water conditioning system, be sure to consult Cochrane water engineers.



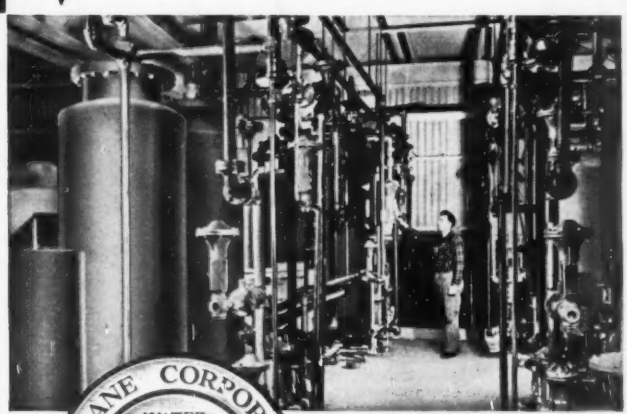
COCHRANE HOT PROCESS ZEOLITE SOFTENER COMBINES EFFICIENCY AND ECONOMY

Combination of a versatile Cochrane Hot Process Softener and a Zeolite second stage provides all the advantages of both systems. It is the most effective and economical means of reducing silica in boiler feedwater preparation. Low total Methyl Orange alkalinities are readily obtained, resulting in lower carbon dioxide in steam generated from this water.

Additional economies and benefits are chemical cost savings obtainable and simplicity of operation. Reason: Inexpensive salt is used for hardness removal instead of more costly soda ash and phosphate. Also, the hardness of the process effluent entering Zeolite units is usually quite low, permitting long Zeolite runs and infrequent regeneration.

LOW COST SOLUTION TO MINERAL SOLIDS PROBLEMS

For economical production of water that is comparable to commercially distilled water in low mineral solids, Cochrane demineralizers are available in multi-bed or mixed bed units of both manual or automatic design for any required capacity. Cochrane demineralizers embody sound design, superior workmanship and conservative ratings to assure maximum operating efficiency and longest life.



Cochrane Automatic Demineralizer producing water of less than 1.0 ppm total dissolved solids in large midwest plant.

Cochrane equipment covers the full range of water conditioning:

HOT PROCESS SOFTENERS
HOT AND COLD ZEOLITE SOFTENERS
DEAERATORS & OPEN HEATERS
DEMINERALIZERS DEALKALIZERS
DEGASIFIERS REACTORS & CLARIFIERS
CONTINUOUS BLOWOFF SYSTEMS
STEAM SPECIALTIES CONDENSATE RETURN SYSTEMS

To give you prompt consultation and service, Cochrane Water Engineers are strategically located in 29 cities throughout the United States. Write for the address of our office nearest you.

COCHRANE CORPORATION — WATER ENGINEERS FOR 90 YEARS — 1863 - 1953

cochrane

corp. 3106 N. 17TH STREET • PHILADELPHIA 32, PA.

In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris

G-E METAL-CLAD SWITCHGEAR lineup is shown during installation in power house at Ford's Lincoln-Mercury plant, Wayne, Mich. Interrupting capacity of magne-blast breakers—totally enclosed bus compartments protect against power shutdowns.

G-E metal-clad switchgear protects power system in huge new Lincoln-Mercury plant

Secondary selective system with packaged units installed at new 35-acre auto plant

Mass production of 1953 Lincoln automobiles—rolling off assembly lines of the new Lincoln-Mercury plant at Wayne, Mich.—depends on the power distribution system behind the machines.

Ford has installed standardized G-E switchgear and nine double-ended load centers to provide safer, more reliable, *protected* power throughout the 1,500,000 square-foot plant, all under one roof.

The compact metal-clad lineup of eight feeder and two incoming line compartments in the power house takes primary voltage at 13.2-kv, purchased by Ford from Detroit-Edison. A bus tie-breaker compartment, with latest metal-clad design improvements, can isolate transformers if failure occurs—gives added reliability by feeding all units in the plant's secondary selective system.

Near switchgear line-up, two double-ended load centers, rated at 1,500-kva each, take care of power house auxiliaries. Seven 2,000-kva double-ended load centers are installed in bays in outer wall of plant building as near to loads as possible. These feed the main factory area.

G-E engineered, factory-assembled switchgear and related equipment can help you in plans for efficient, flexible, *dependable* power distribution systems. Call your local G-E Apparatus Sales Office—or write to General Electric Co., Schenectady 5, New York. 874-2

TIE-BREAKER GIVES dependable power in secondary selective system throughout Lincoln-Mercury plant. Bus tie-breaker in switchgear section contains new elevating mechanism.

PLANT ENGINEERS inspect load center unit substation in power house, shown here immediately after energizing. This is one of nine new units installed in plant.

INCOMING BUS at rear of compact, factory-engineered switchgear compartment is wired and wrapped. Rigid doors and frame of G-E metal-clad give added safety.

SMALL BAYS along outer walls of 35-acre plant each contain double-ended load-center substations, place them near assembly-line operations on main plant floor.

POWER FEEDS factory area through double-ended 2,000-kva load centers. Transformer's high side is being connected here with cable from pothead to oil switch on platform.

GENERAL ELECTRIC

Harnessing heat for all industry

HEAT is one of man's most useful servants. With it, he can separate gasoline from crude oil . . . cook food . . . generate electricity . . . refine steel from raw ore and roll it into mile-long sheets. But to do these and countless other jobs, heat must be applied in the correct amounts . . . to obtain critical temperature values.

Forward-looking research and production men realized some years ago that "rule of thumb" was entirely inadequate for replacing complex processes. They needed facts obtainable only from automatic measurement . . . performance possible only through automatic control.

Honeywell has consistently led the way toward new and better temperature instrumentation. Continuing research has developed sensing elements which cover the full temperature spectrum . . . instruments which provide the desired accuracy . . . and automatic controls which can regulate any production process.

instruments

The complete Honeywell family offers a broad choice of characteristics to suit individual applications. *ElectroniK* indicators, circular chart and strip chart recorders and controllers afford the peak in performance through "Continuous Balance" high-speed electronic measurement. *Pyr-O-Vane* millivoltmeter instruments fit many processes which need accurate indication and control. Brown Thermometers are economical instruments for recording and controlling moderate temperatures.

controls

With *Pyr-O-Vane* instruments you can have electric control of either the two-position, three-position or time-proportioning types.

With Thermometers, you may choose from electric two-position, pneumatic on-off or proportioning control, and cam-operated program control.

With *ElectroniK* instruments, your selection covers practically any form of electric or pneumatic control, including the most advanced types suitable for complex processes, and the most flexible program controls.

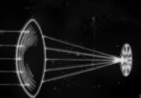
Watch 270 plant *with the*

sensing elements

thermocouples

the most versatile of temperature elements, are supplied for ranges from −300 to +2800° F.

Radiamatic



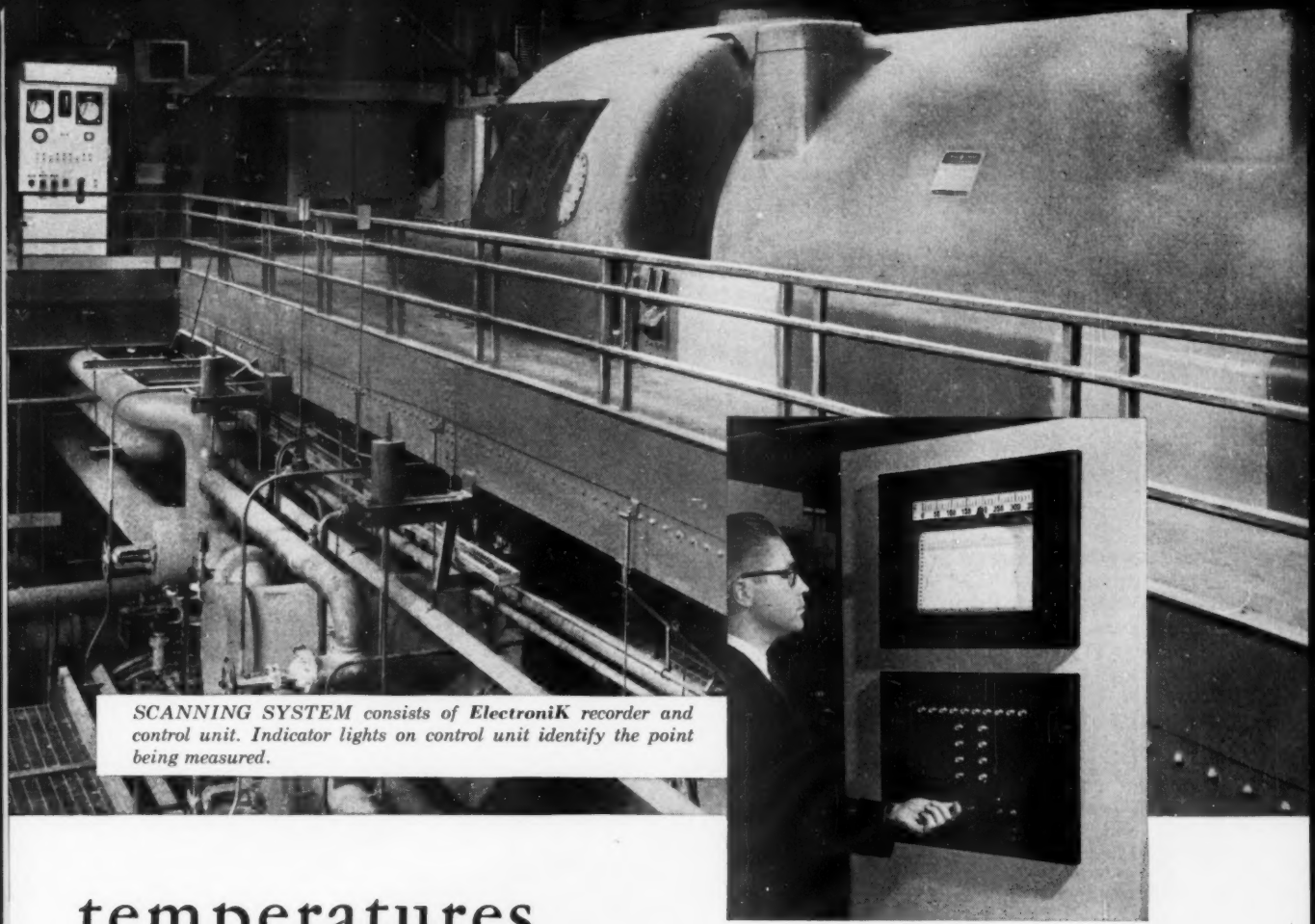
(radiation-type) elements are applicable to direct measurement of work temperature . . . to moving objects . . . to extremely high ranges and other jobs impossible for any other element.

resistance thermometers

are recommended for highest accuracy from sub-zero to 300° F. and for narrow spans.

thermometer bulbs

rugged, sensitive elements for moderate temperatures.



SCANNING SYSTEM consists of ***ElectroniK*** *recorder and control unit. Indicator lights on control unit identify the point being measured.*

temperatures *ElectroniK* **scanner**

IT'S EASY and economical to keep constant watch over temperatures of potential trouble spots throughout the plant, when you have an *ElectroniK* Scanning System. From a central point, you can monitor temperatures of bearings, hydraulic couplings, boiler tubes, cooling oil lines . . . at surprisingly low cost per point.

This instrument can concentrate data from as many as 270 different locations. It scans through successive thermocouple points at a rate as fast as one second per point . . . re-checking each point at approximately four-minute intervals.

At the operator's choice, it can perform these various functions: simple scanning without recording, continuous recording of all 270 points, selective recording, recording of points which depart from specified limits, and operation of annunciator contacts when any temperature exceeds a pre-set point. The chart moves only when the instrument is actually recording. Separate temperature limits can be set for each bank of 9 thermocouples.

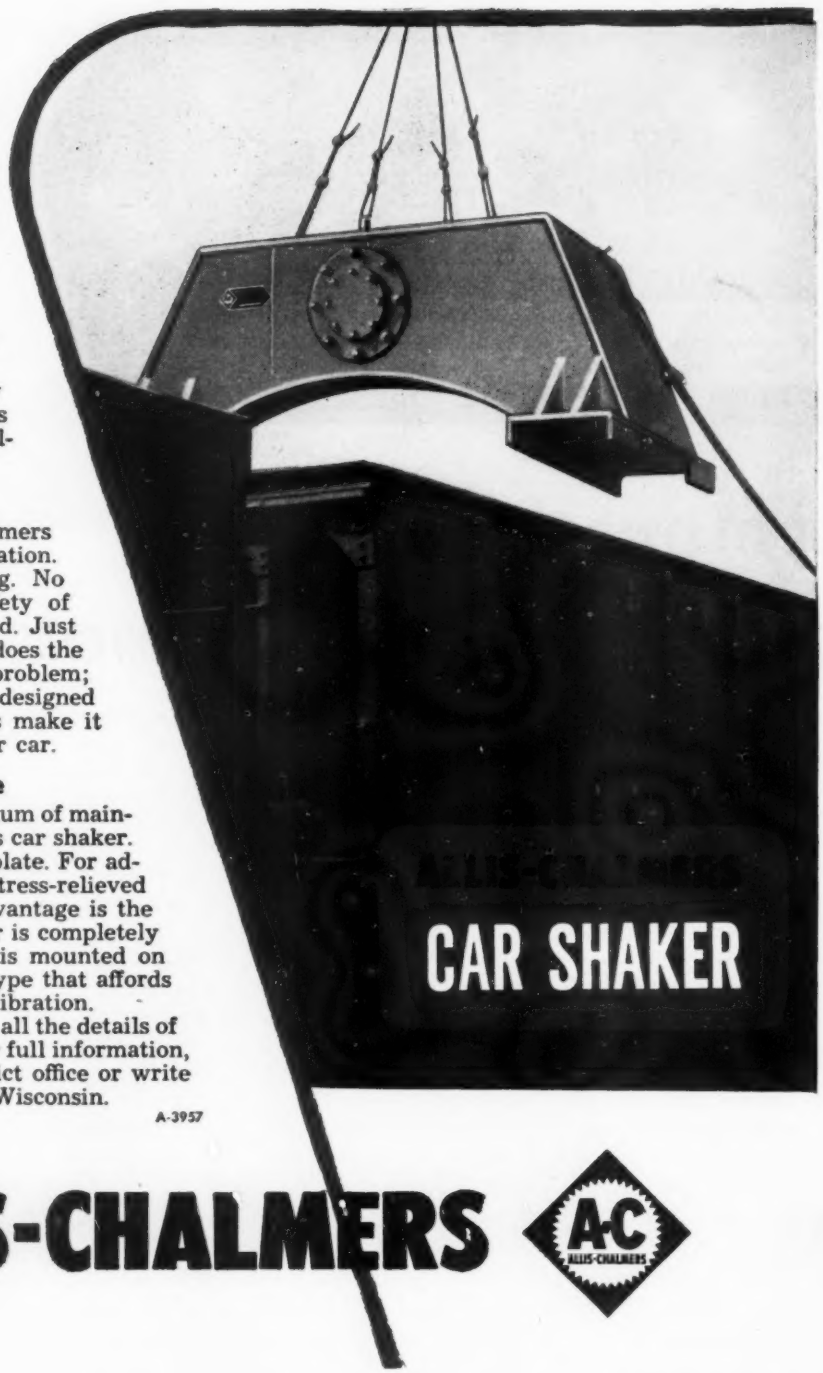
Your local Honeywell engineering representative will be glad to discuss how this instrument can help you protect plant equipment economically. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA:** Write for Data Sheet No. 10.0-1, "*ElectroniK* Scanning System," and Catalog 90-2, "Supervisory Instruments for Power Generation."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

CUT UNLOADING COSTS



You can save time and money using Allis-Chalmers car shakers for unloading cars. Here are two examples: **(1)** You can unload cars of wet sand or like materials in 1½ to 2¼ minutes; **(2)** you can unload coal in 1 to 6 minutes, depending on surface moisture.

In fact, you can unload any material in minutes, even if it is damp, compacted or in a partially frozen condition.

One-Man Operation

Best of all, using an Allis-Chalmers car shaker is a one-man operation. No more pounding or digging. No more worrying about the safety of men inside cars being unloaded. Just press a button; the car shaker does the rest. There is no positioning problem; Allis-Chalmers car shakers are designed to hang level, and wide shoes make it easy to engage any size hopper car.

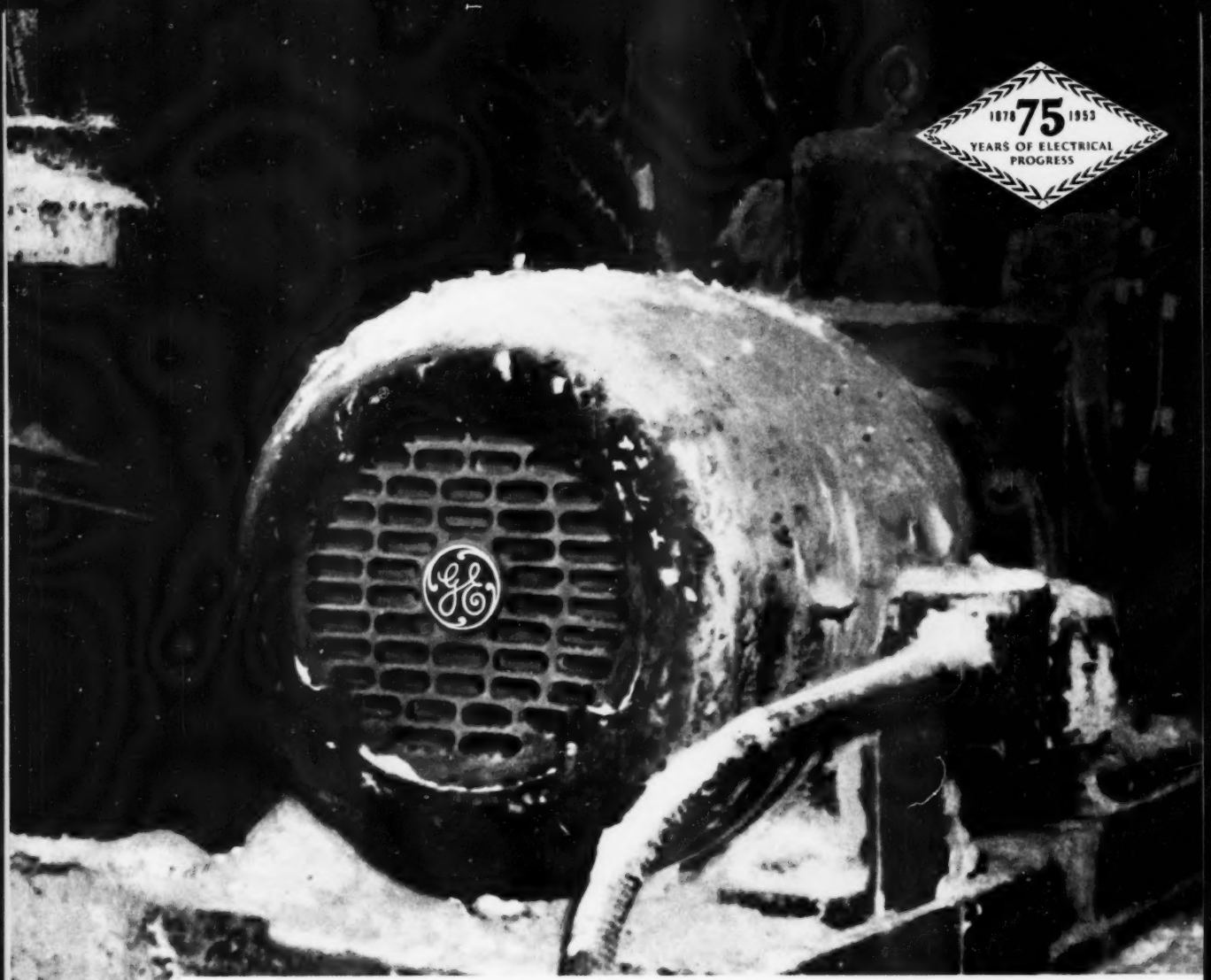
Low Maintenance

You'll get long life and a minimum of maintenance with an Allis-Chalmers car shaker. Sides and top are heavy steel plate. For additional strength, the body is stress-relieved after welding. Another big advantage is the power arrangement. The motor is completely enclosed in the body. And it is mounted on rubber shear mountings of a type that affords maximum protection against vibration.

It will pay you to investigate all the details of Allis-Chalmers car shakers. For full information, consult your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3957

ALLIS-CHALMERS



1878 75 1953
YEARS OF ELECTRICAL PROGRESS

Corrosion won't hurt this TRI CLAD motor's cast-iron frame

REG. U.S. PAT. OFF.

HERE'S A COMMON SIGHT AROUND MANY PLANTS—A G-E Tri-Clad motor operating reliably and continuously under the extremely corrosive conditions that cause many other motors to fail.

THAT'S WHY YOU CAN EXPECT superior performance from G-E Tri-Clad motors. Consider these facts:

CORROSION-RESISTANT CAST-IRON means longer motor life. Unlike steel, cast-iron resists corrosive pitting, even when the paint is chipped.

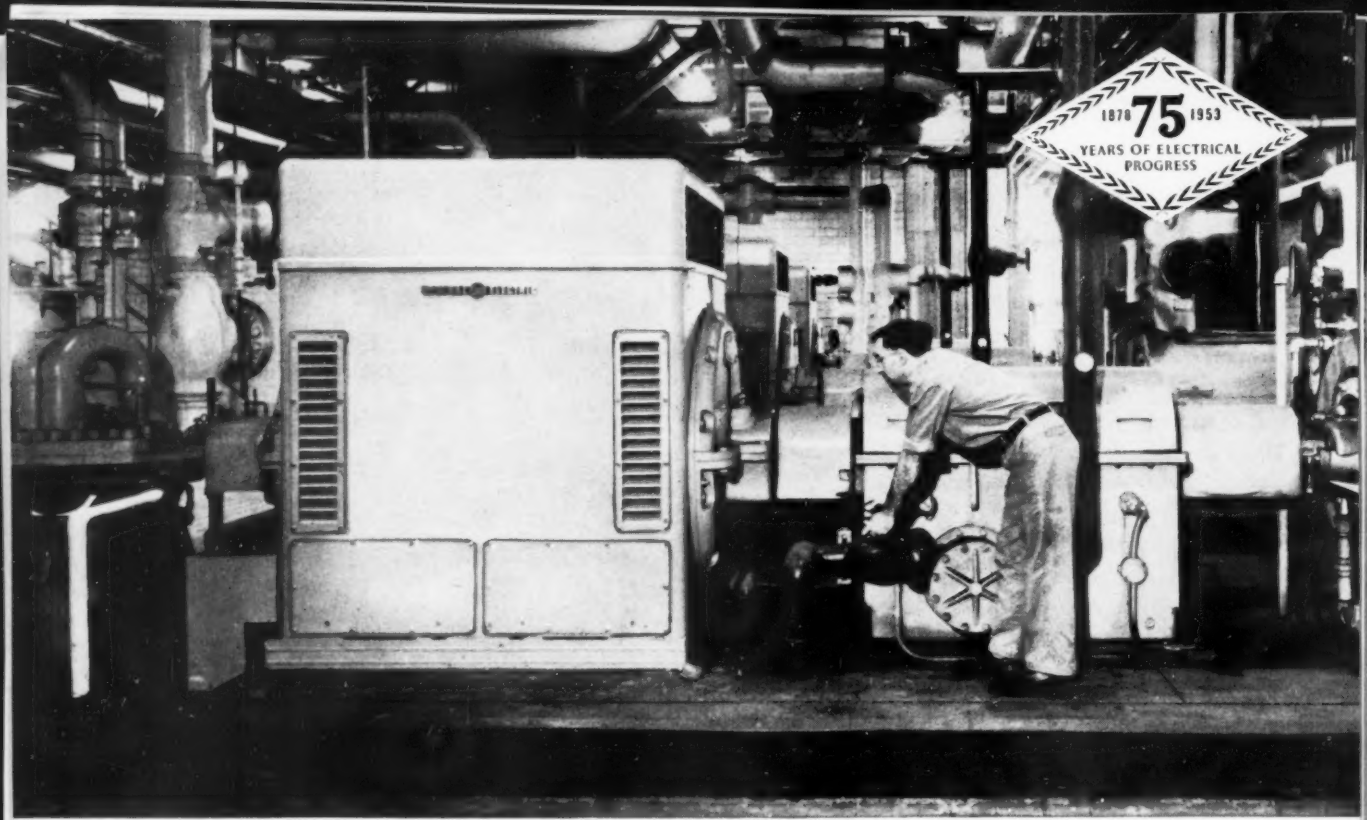
RIGID, CAST STATOR FRAME with integrally cast feet, can't be twisted out of line by accidental jarring or by excessive "bolt-down" pressure on the feet.

STRONG, CAST-IRON END SHIELDS have cast ribs for extra strength without adding extra weight . . . protect the true motor alignment even under heavy shaft loads.

ORDER G-E TRI-CLAD MOTORS from your nearby G-E Apparatus Sales Office or G-E Agent or distributor. General Electric Co., Schenectady 5, N. Y. 752-19

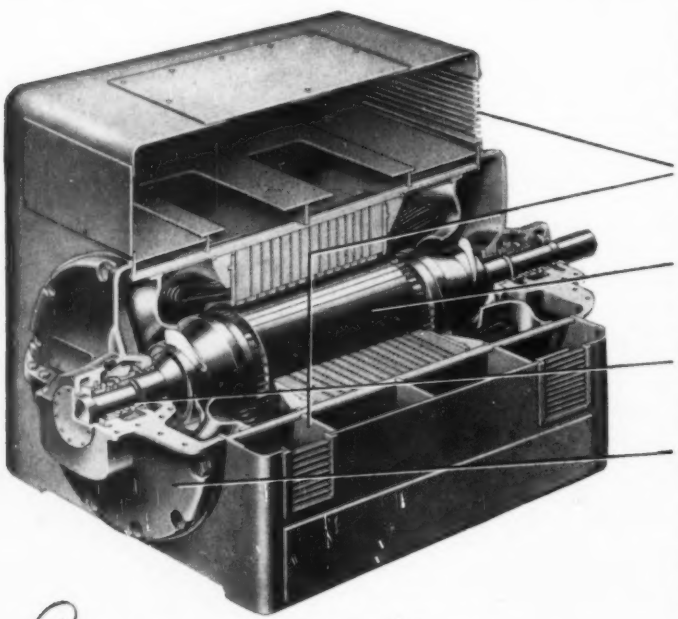
You can put your confidence in—

GENERAL ELECTRIC



DETROIT EDISON RELIES ON 3 G-E BOILER FEED PUMP MOTORS IN THEIR MODERN CONNERS CREEK STATION BECAUSE . . .

New G-E Boiler Feed Pump Motors Are Custom-built for Power Stations



Here's a motor designed especially for boiler feed pump service. It's a revolutionary design . . . with modern styling . . . operates quietly . . . directs discharge air away from personnel . . . conserves valuable floor space in power stations.

UNIQUE VENTILATION SYSTEM permits closer parallel spacing of motors . . . prevents recirculation of heated discharge air . . . improves personnel comfort. Air entering sides is discharged high above endshield away from adjacent motors and personnel.

STREAMLINED ROTOR construction prevents "siren" effect—built-in air deflectors and large discharge chamber cut over-all noise level.

DUAL LUBRICATION SYSTEM combines the advantages of force-flood lubrication and self-lubricated oil rings . . . gives extra protection . . . assures long, reliable bearing life.

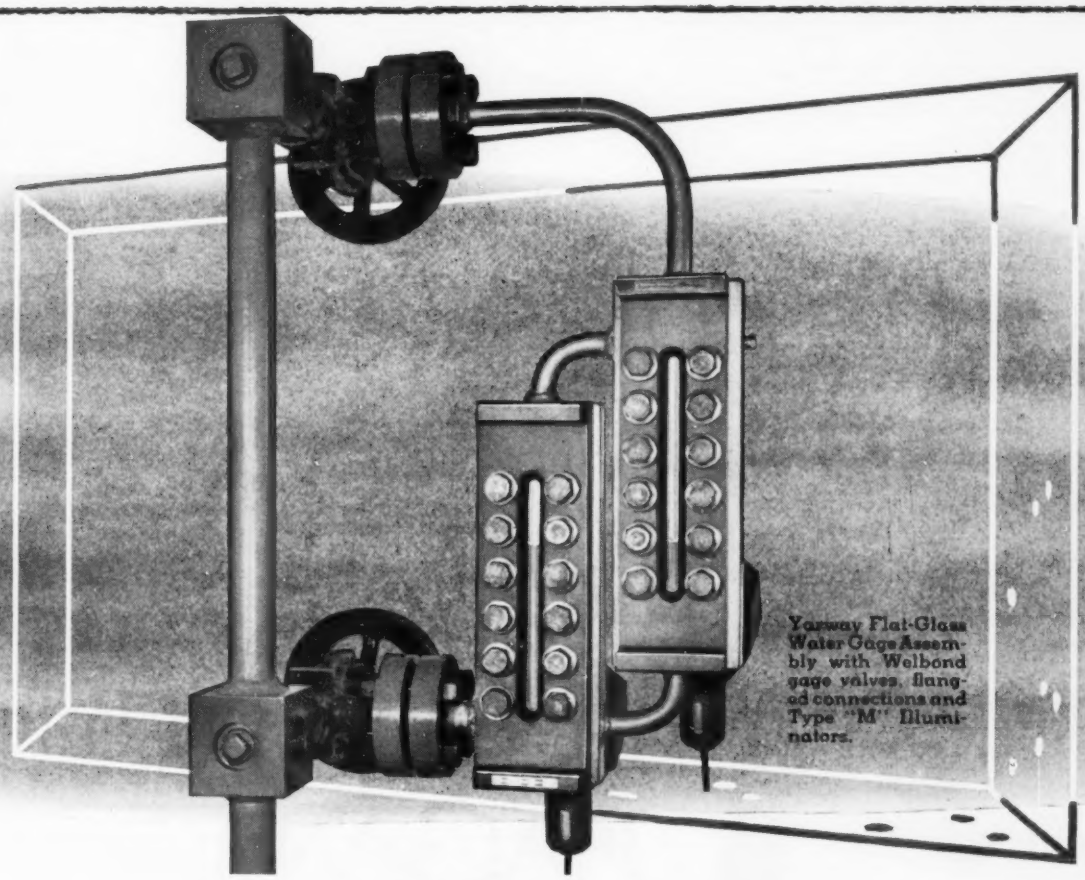
COMPLETE 360 DEGREE ENDSHIELD supports bearing from top as well as bottom . . . assures continuous, accurate bearing lineup. Both endshield halves are sturdy ribbed castings.

For more information contact your G-E representative or write for Bulletin GEA-5813 to General Electric Co., Section 753-2, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

What's New
IN BOILER WATER LEVEL INDICATION?



Yarway Flat-Glass Water Gage Assembly with Welbond gage valves, flanged connections and Type "M" Illuminators.

NEW *SEPARATED-DESIGN* WATER GAGES

This new Yarway water gage assembly has been developed to meet the demands for greater dependability, longer life, and more accurate readings in high pressure service.

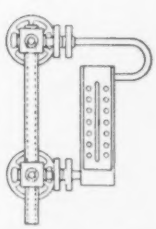
The gage glass inserts are of the Yarway pressure-sealed "floating assembly type". Yarway Welbond gage valves are used. Greater flexibility is gained by using two independent inserts, and by interconnecting expansion loops (see above).

The short connection to the drum assures greater accuracy of the gage reading, and the lower flanged connection eliminates a stuffing box. The upper flanged loop connection between the insert and gage valve allows expansion and contraction of the various components.

The tie bar-type water column linking the gage valves provides circulation to keep gage nearer drum temperature.

Yarway Type "M" Illuminators on the gage inserts cause the meniscus at water level to "shine like a star". This illuminator is especially effective in penetrating deposits on gage glass, dust particles in air and extraneous light.

For full information, write for Yarway Bulletin WG-1811.



Yarway Single Insert type gage for medium range of visibilities.

YARNALL-WARING COMPANY • 100 Mermaid Avenue, Phila. 18, Pa.

YARWAY® STEAM PLANT EQUIPMENT

...when you install HAGAN Automatic Combustion Control and HAGAN Ring Balance Meters

HAGAN
HALL
BUROMIN
CALGON

When you install Hagan Automatic Combustion Controls and Hagan Ring Balance Flow Meters, you are certain of accurate and dependable results, low maintenance costs, increased efficiency and economy of operation.

A system of Hagan Automatic Combustion Control is available for your plant, regardless of the number or size of boilers, steam pressure and temperature, or the combination of fuels to be controlled.

Whether your plant operation requires indications, records, or totalizations of flow, in any combination, there is a Hagan Ring Balance Meter built for the job. Any fluid flow—steam, water, liquid fuels, gases, compressed air—can be measured at any pressure up to 15,000 psig. Automatic temperature and pressure compensation of flow readings are available. Two flow readings can be added or subtracted in a single meter.

For combustion control and metering systems which are versatile, accurate, and durable, install HAGAN. Our engineers will be glad to show you what HAGAN Combustion Controls and HAGAN Ring Balance Meters can do.

HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING FACILITIES

KENNEDY Pulverized Coal

KVS Air Swept Tube Mill is designed to provide extremely fine pulverization of any grade of coal. Worm drive, mounted in roller bearings with gear and worm direct-connected to shaft. Produces a fineness of 90% to 95% through U. S. standard 200 mesh screen. Up to 20% moisture removed during pulverizing operation. Ferris wheel type lubricating system with oil reservoir in base of bearing. Anti-friction bearings on gear shaft lubricated by oil splash.

INSTANT RESPONSE TO ALL COMBUSTION REQUIREMENTS

● KVS Air Swept Tube Mills assure complete and rapid combustion through extremely fine pulverization of any grade or quality of coal... wet or dry... regardless of grindability.

All the heat value of coal can be utilized at lower cost with the KVS method than by any other coal pulverizing equipment. YOU CAN SAVE UP TO A DOLLAR PER TON ON EVERY TON OF COAL YOU BURN!

Such important savings will more than pay for the equipment in a very short time and continue to pay dividends for years to come.

KVS offers engineering service in the design, building and erection of complete steam power plants for firing lowest grade fuel, screening, tailings etc. or for any solid or liquid that will burn. Get particulars of this service *before* you specify.

KENNEDY

Pulverized Coal Firing Installations are in use in leading plants throughout the world.

Let our engineering department furnish complete boiler designs for your steam requirements. Plans and estimates that will reduce your fuel and operating costs.

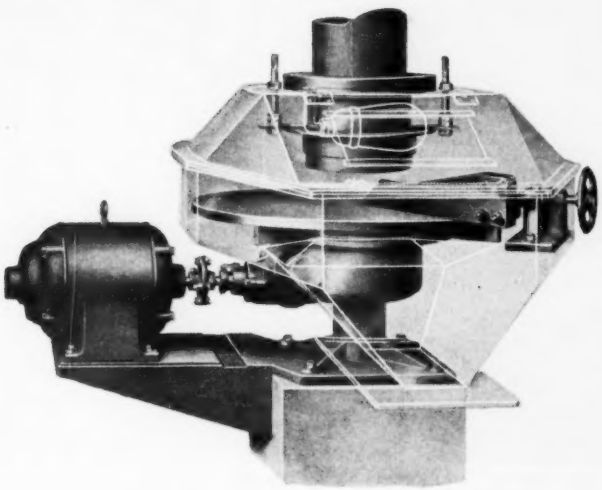
Firing Systems CUT FUEL COSTS TO THE BONE!

A FEEDER THAT HAS NO EQUAL FOR EFFICIENCY AND RELIABILITY

● The KVS enclosed Disc Feeder offers many advanced features which contribute to efficiency and ease of operation. For example:

Feeder is internally illuminated with a glass door in housing for visual indication of the moving coal. Electric motor drives rotating disc through worm gear, enclosed in oil and dust tight housing.

Telescopic sleeve installed on the down spout from coal bunker terminates above feeder disc, the coal forming a cone between sleeve and disc. An adjustable knife or plow cuts into the coal cone and spills it over the edge of disc into feed chute of pulverizer. Continuous operation of feeder not affected by tramp iron or other foreign substance.

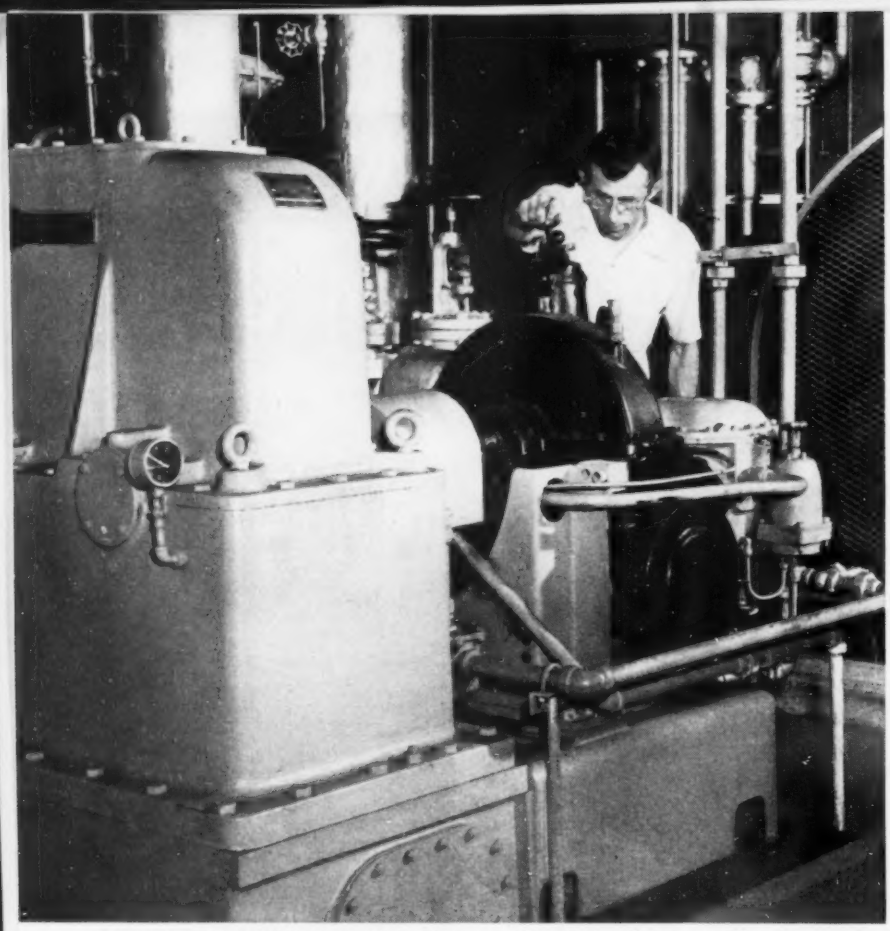


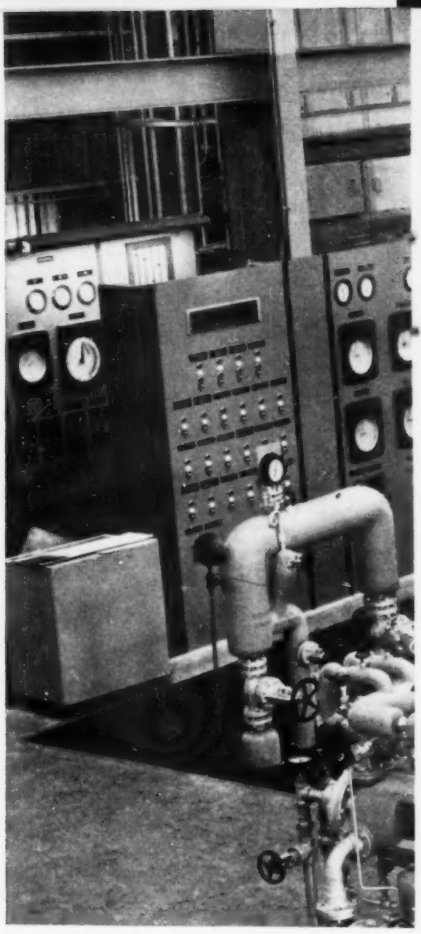
KVS Enclosed Disc Feeder prevents coal dust from escaping into boiler room. Rate of feed varied by changing position of knife which cuts into coal cone or by changing speed of disc by means of adjustable speed control of the drive motor.

Volumetric type; accuracy not distributed by moisture contained in coal.

IT COSTS LESS.. TO OWN THE BEST!

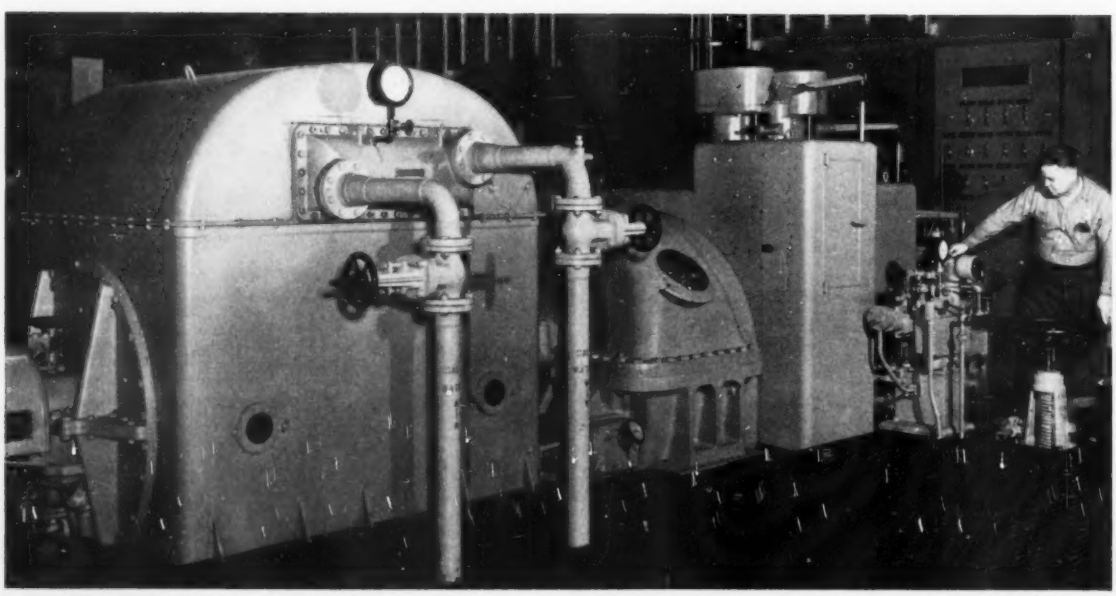
KENNEDY - VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
TWO PARK AVENUE, NEW YORK
FACTORY DANVILLE, PA.



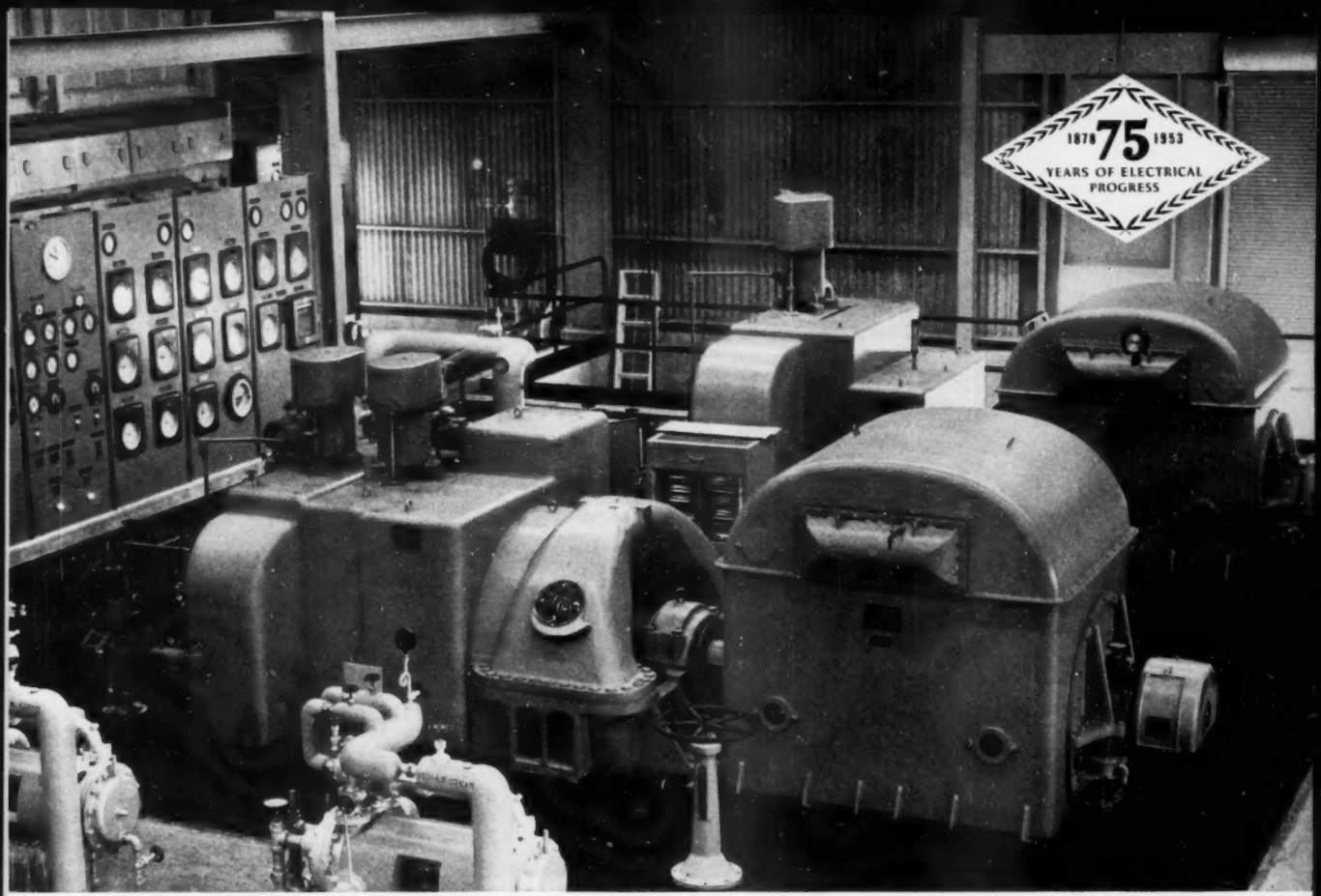


G-E TYPE DP MECHANICAL-DRIVE TURBINE, rated 135 hp, drives standby air compressors. J. A. Chamberlain, Supervisor of Utilities at Barber Refinery, checks turbine.

G-E Turbines Maintain Plant Steam



EASY STARTING of the General Electric 2000 KW double extraction turbine-generator at California's Refinery is demonstrated by W. E. Riley, Station Operator. Handwheel initiates small pilot valve, requires almost no muscle effort to operate.



DOUBLE-EXTRACTION CONDENSING TURBINE-GENERATOR in foreground supplies process steam at 150 psig and 15 psig for refinery operations at "California's" Barber, New Jersey plant. Other turbine is straight condensing.

Balance at "Calso's" Barber, N.J. Refinery

2000 KW Turbine-generators Reduce Boiler Steam to Process Pressures; Mechanical-drive Turbine with High-speed Precision Gear Drives Utility Air Compressor.

To make fullest use of available high-pressure steam, to obtain economical by-product power, and to automatically maintain plant steam balance over a wide range of steam flows, the California Refining Division of The California Oil Company selected two General Electric turbine-generators for its Number Two plant at the Barber, N. J. Refinery.

Extraction steam from one turbine-generator, a 2000 KW unit, is delivered at 150 psig and 15 psig for various process uses. Turbine governing accuracy is such that even when extraction steam or electrical load requirements vary, extraction pressures are held constant. A second 2000 KW unit exhausts to a condenser.

The "California" Refinery also installed a General Electric Type DP mechanical-drive turbine with a G-E high-speed precision gear to drive one of the compressors which furnishes utility air for use throughout the refinery. In an emergency, this turbine-driven compressor could meet complete compressed air demands.

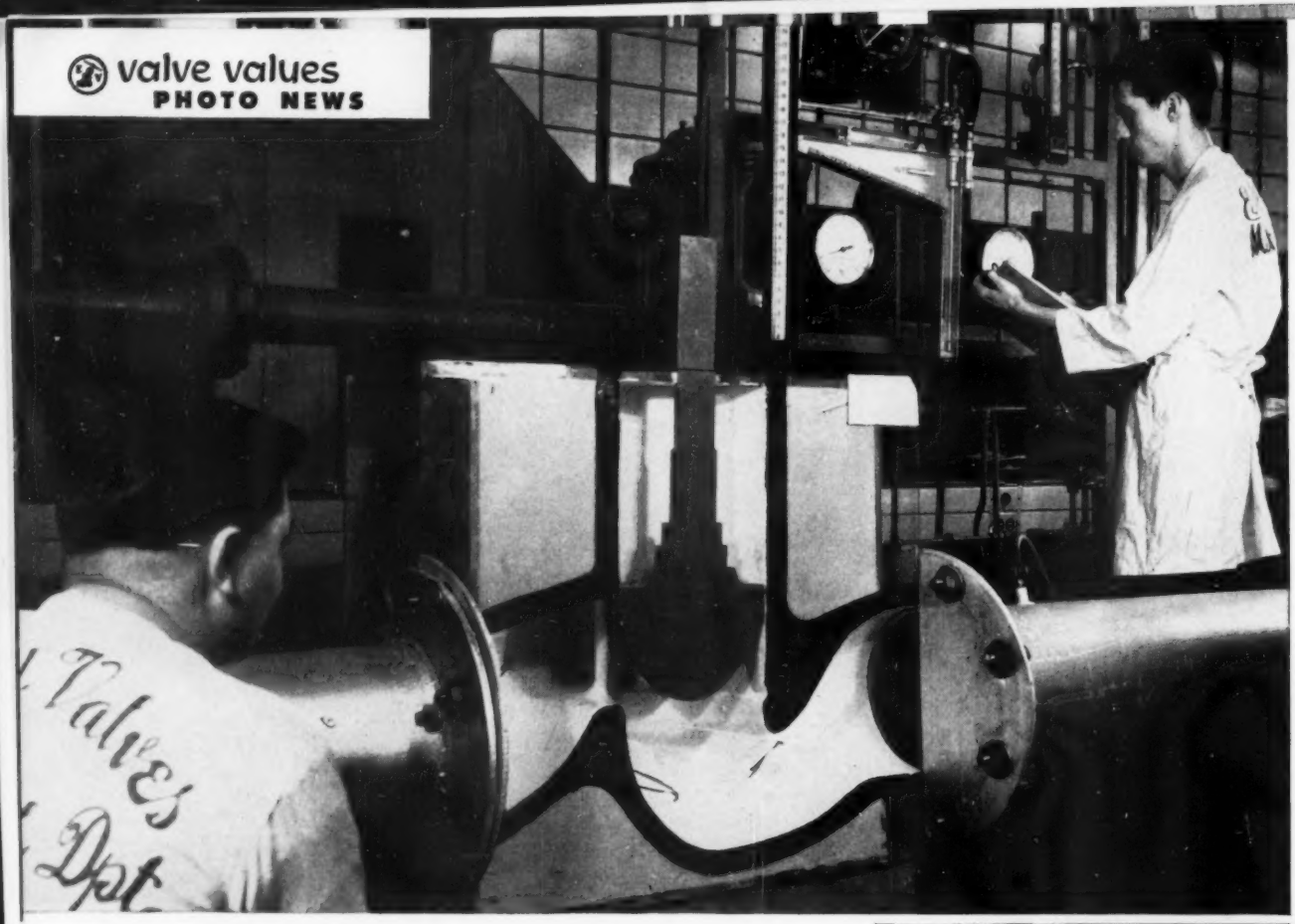
If your plant uses process steam, why not take advantage of G.E.'s experienced turbine engineering resources. G-E engineers will study and recommend ways for you to best utilize steam supply. Get more for your turbine dollar with G-E turbine-generators. General Electric, Schenectady 5, N. Y.

256-5

You can put your confidence in—

GENERAL ELECTRIC

valve values
PHOTO NEWS



Up to 30% More Flow, Less Pressure Drop, FOR EDWARD VALVES

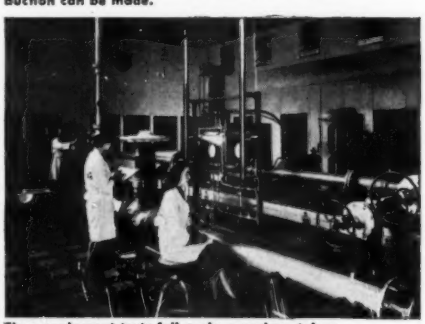
One of the basic first steps in the development of any new valve design at Edward is the thorough analysis of its flow characteristics and the precise determination of pressure drop. No guesswork is tolerated. Exclusive laboratory techniques permit technicians to actually see flow through the proposed design and to measure precisely all flow characteristics.

Plastic "half-models," as illustrated, are placed in specially designed flow equipment where pressure loss can be readily and minutely measured. Through the use of streamers, colored smokes and special measuring techniques, pressure-stealing, wear producing turbulence and other flow phenomena are revealed to the researcher's trained eye, thus readily corrected. Change after change is made in the plastic model until the design with the greatest possible flow and least possible pressure loss and turbulence has been evolved.

Plaster casts are then made, sectioned, and carefully measured with specially developed equipment. The pattern maker's art and the latest foundry and forging processes then transform the experimental plastic "half-model" into a full scale steel valve with minimum pressure drop and up to 30% greater flow than ordinary valve constructions.

At Edward the determination to omit no painstaking design step has contributed greatly to the development of valve designs that are today the most copied in the field. Dozens of features that were Edward "firsts" are now industry standards. And many patented features are still exclusive with Edward.

Plaster cast of valve design having best flow characteristics is sectioned and minutely measured so that patterns for top quality valve production can be made.



Flow equipment tests full scale experimental or finished steel valves—above a 10-inch 900-lb sp Non-Return valve undergoing flow test. Flow meters and gages indicate pressure changes, other flow data.

Edward Valves, Inc. Another Product

25-50% Less Pressure Drop, Lower Maintenance with
EDWARD UNIVALVES

In Edward Univalves, all-purpose globe valves for high temperature-pressure service, streamlined internal contours and a patented inclined stem construction provide straight-through flow, as illustrated below. As a result, tests have proven this all forged steel valve to have a pressure drop 25 to 50% lower than other types of globe valves. The streamlined contours also minimize turbulence, thus adding life to internal parts by eliminating the principal cause of wear producing vibration.

These advantages, plus many other features, have over the last ten years established the Univalve (T.M. REG.) as the industry standard for tough applications. For example, many Univalves are used in punishing blowoff service. They meet all ASME boiler code requirements for blowoff valves and are ideal for boiler pressures from 600 to 3120 lbs.

A patented body-bonnet joint consisting of a shoulder, a threaded connection, a guiding section and a seal weld assures perfect alignment and pressure tightness in any service. The seal weld may be readily removed for repair of seating surfaces damaged by foreign matter being trapped in the valve.

Use of heavy stellite ring on body and disk seating surfaces assures long life in high temperature service. Seats are integral with body, and are machined in same set-up with body bore for perfect alignment. Wide contact faces on seating surfaces are carefully lapped and mated to insure positive shut-off.

Special attention has been given to the packing, necessarily the most vulnerable spot in any valve of this type. A positive engineered backseat completely isolates packing chamber from the line pressure when valve is full open, stretching packing life. If repacking becomes necessary, this backseat permits replacement of packing while valve is under full line pressure.

Univalves are furnished in 1500 and 2500 lb. pressure classes in sizes from ½ in. to 2 in. Valves over 1 in. have Impactor Handle, 2.8 times as effective as ordinary handwheel, as standard equipment. Univalves are normally supplied with socket ends, although screwed ends and flanged ends are available on special order.

Write for Catalog 12 G1 for complete information.

EDWARD VALVES, Inc., *Subsidiary of*
ROCKWELL MANUFACTURING COMPANY
1220 W. 144th STREET • EAST CHICAGO, INDIANA

GLOBE AND ANGLE STOP • FEED-LINE • BLOW-OFF • NON-RETURN CHECK • GATE • GAGE AND INSTRUMENT • RELIEF • STRAINERS

COPYRIGHT 1953, EDWARD VALVES, INC.

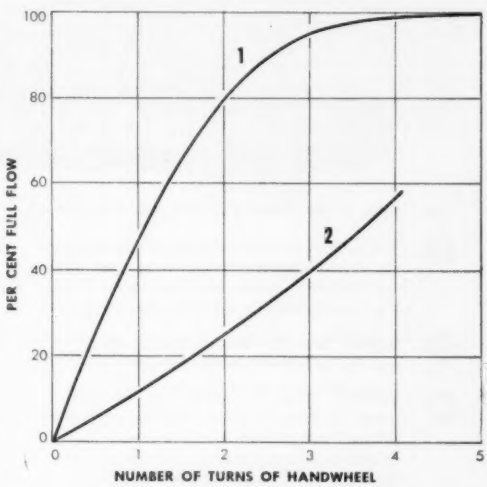
Technical Tips

Use of Globe Valves for Throttling Service

Experience has shown that globe valves are to be preferred in locations which require tight shut-off and services which may call for throttling. Forged steel inclined stem globe valves give many of the free flow characteristics typical of gate valves and combine the tightness and ability to throttle characteristic of globe valves.

The chart below shows the flow characteristics of typical inclined stem forged steel globe valves in relation to handwheel opening. Curve No. 1 shows the per cent of full flow capacity flowing through an inclined stem globe stop valve for each successive turn of the handwheel up to five. The major portion of the throttling control takes place in the first two turns of the valve handwheel. The amount of flow is essentially a straight line variable within this range.

For comparison, a typical globe valve with V-port throttling disk is shown on the same chart. The V-port valve is designed to give less flow per handwheel turn so that closer regulation can be obtained. However, in the wide open position the total is only about half that of a general purpose inclined stem globe stop valve.



1. Globe Stop Valve **2. V-Port**

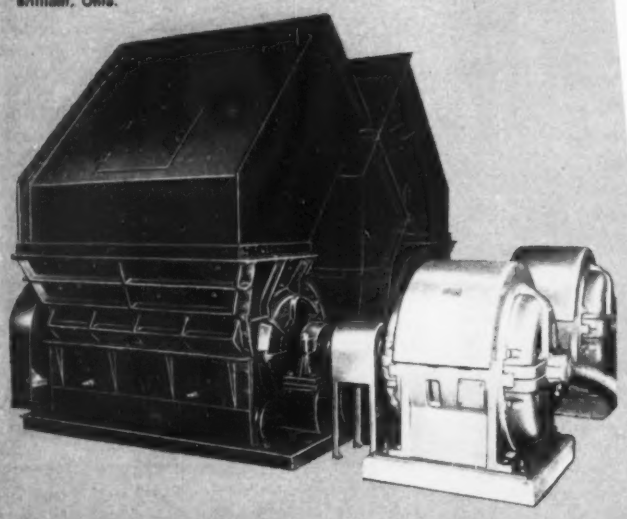
Globe stop valves are sometimes installed as variable volume regulators in carefully calibrated flow systems, but their widest use lies in general purpose installations. The curve shows that a few simple rules can be followed for throttling operations. A half turn open gives about ¼ flow, one turn open about ½ flow, two turns open about ¾ flow.

When closing down from the wide open position, the rule is not so simple. Different sizes and figure numbers of inclined stem globe valves will have different numbers of handwheel turns from wide open to closed. If a rough measure of throttling is desired, it is best to close the valve down and then open a certain number of turns rather than to try to close from the wide open position with a specific number of turns.

Edward

Check *American* Quality—Feature by Feature—and you'll know

Four Million Tons of Coal Crushed in Six Years!
Reducing 16" ROM to a ¾" product, at the rate of 900 tons per hour, is the performance record of this American 60S twin-crusher installation at the Tidd Plant of the Ohio Power Co., Brilliant, Ohio.



WHY AMERICAN CRUSHERS can reduce coal for less than

per ton

AMERICAN Feature No. 2

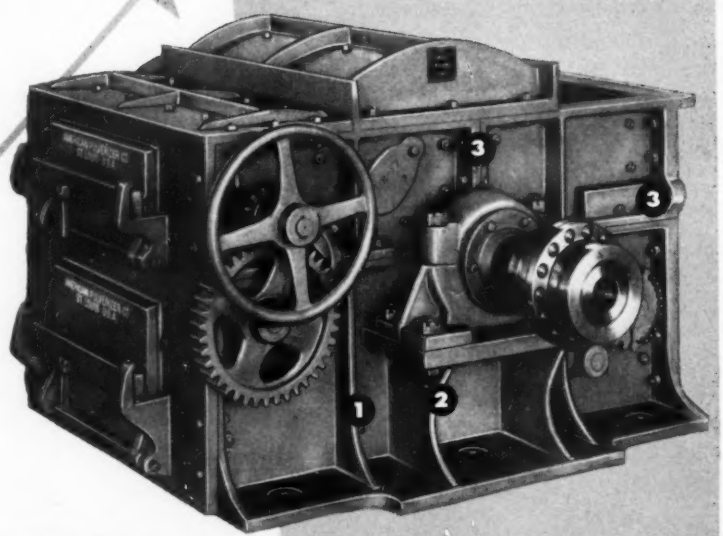
STRONGLY RIBBED STEEL FRAME

The frame of an American Crusher consists of:

1. **Side Frames of Heavy, Ribbed Steel Castings,** accurately machined on special jigs and fixtures. Each abutting joint is machined for dust-tight fit. All other members are of heavy plate steel.
2. **Integral Bearing Pedestals.** Cast in one piece with the side frames to assure maximum rigidity.
3. **Sectional Design.** All members of the crusher frame are securely bolted together by means of coupling bolts rather than machine bolts—to provide a much stronger and more rigid joint. The sectional design permits easy dismantling of the crusher, or quick inspection of parts for check on wear or replacements.

American Crushers are designed for a lifetime of wear. The crushing chamber of every American is **completely** protected with renewable liners of the proper thickness and material for every job.

WRITE for Coal Crushing Bulletin



American PULVERIZER COMPANY

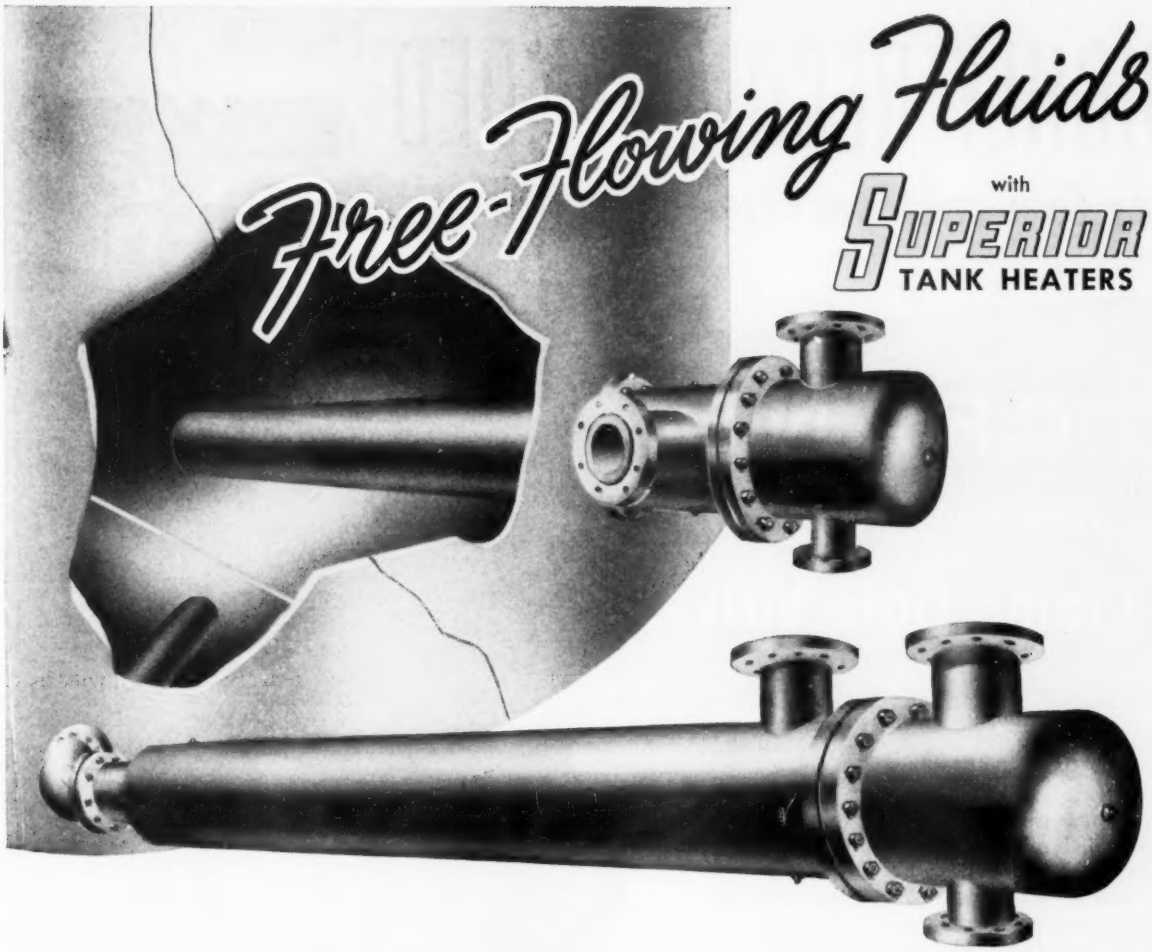
Originators and Manufacturers of Ring Crushers and Pulverizers

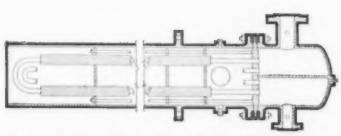
1349 Macklind Ave.
St. Louis 10, Mo.

Free-Flowing Fluids

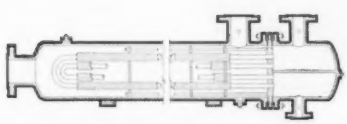
with

SUPERIOR TANK HEATERS





Open-end Type C1U is designed for internal installation . . . applying heat directly at the point of suction.



Type C2U provides for installation exterior to the storage tank. Tubes may be bare, or finned, as required.

SUPERIOR TANK HEATERS are used to heat viscous fluids pumped from storage *without the necessity of heating the entire contents of the storage tank.* With steam, or other heating medium supplied to the "U" tubes, only the liquid withdrawn from storage is heated to the required temperature.

SUPERIOR Heat Exchangers are available in a wide range of sizes and in a variety of shell, tube-bundle, and head designs to meet all conditions of heating, cooling, condensing and evaporating.

Our engineering staff invites your inquiry regarding any proposed installation . . . as a basis for a specific engineering recommendation. For details of construction, write today for fully illustrated Catalog 5010.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
HEAT EXCHANGERS

HIGHLY RECOMMENDED

for low cost service

CRANE

IRON BODY—WEDGE DISC

Clamp Gate Valves

Crane Wedge Disc Clamp Gate Valves come in OS&Y, inside screw, and quick-opening patterns, all-iron or brass trimmed, screwed or flanged end. Sizes up to 4 in. Working pressures up to 150 p.s.i. saturated steam, 225 p.s.i. cold service.

Low in first cost, as well as in upkeep . . . and look at their wide utility—

Use Crane Clamp Gate Valves for steam; hot and cold water; crude, fuel, and lubricating oil; air, gas, and gasoline service.

Also in food and chemical process industries for caustic solutions, alkalies, corrosive chemicals, and gases.

You'll find Crane Clamp Gate Valves extra rugged, with a strong reinforced body and husky stem. Their compact design means a better fit for more places . . . a saving on piping in many cases. And because of the simplified clamp construction, these valves enjoy wide favor where frequent cleanout is essential. The bonnet assembly and wedge disc lift out easily—the body stays in the line. Reassembling is no problem—the bonnet joint makes up tight and stays tight.

Wide choice of regular patterns, all-iron or brass trimmed. On inside screw all-iron valves, an improved self-draining bonnet prevents entrapment of line fluids in the bonnet—protects the threads, keeps the stem working smoothly. Send for Folder AD 1667 or ask your Crane Representative for full details.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

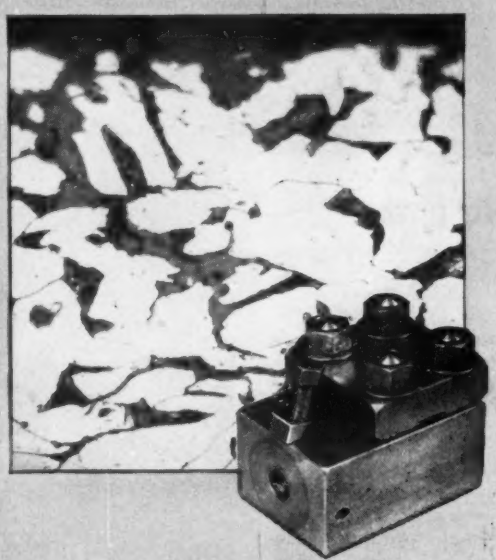
CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Eliminate the Danger of

INTERCRYSTALLINE CORROSION

ALLIS-CHALMERS WATER CONDITIONING
Equipment — Chemicals — Service



Photomicrograph of edge of crack caused by intercrystalline corrosion. U. S. Bureau of Mines detection unit (inset) tests for causes of intercrystalline corrosion.

Dangerous and costly cracks due to intercrystalline corrosion (embrittlement) will be no problem in your boilers if you have given careful consideration to the problem *in advance*. You can get the information you need to analyze your operations from Allis-Chalmers water conditioning Bulletin 45. It explains intercrystalline corrosion — the cause of embrittlement. It tells what tests are necessary to recognize this condition. And it discusses what you can do.

Get the Answer to Many Problems

Bulletin 45 is one of a series of Allis-Chalmers bulletins on water conditioning problems. Like all of these useful bulletins, it is based on the wide experience of Allis-Chalmers water conditioning men in handling water problems for nearly every industry. In addition, it is based on Allis-Chalmers long experience building turbines and power plant equipment.

Complete Service Available

Allis-Chalmers gives you complete water conditioning service. You can get analyses and reports on your problems. You can get the chemicals needed in all water treatments. And you can get the equipment for any system.

A-4014

For your copy of Bulletin 45 on intercrystalline corrosion, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby Allis-Chalmers district office and have an Allis-Chalmers representative consult with you on your water problems.

ALLIS-CHALMERS

Unloaded 3,207,708 Tons

ENGINEERING DATA

MODELS: 5-ton HD (Heavy Duty) . . . 3½-ton GS (General Service) . . . Both fit all hopper bottom cars in domestic service.

DUTY: GS Model generally recommended for 10 cars per day, HD Model up to 100 cars per day handling wet, compacted or partially frozen loads. (Capacity figures vary depending upon characteristics of material).

SPECIFICATIONS: 5/32" stroke—1,500 vibrations per minute (easily adjustable for specific applications) . . . Motor platform suspended on coil springs to protect motor from vibration . . . HD Model vibrating frame of welded construction throughout, stress relieved after welding . . . GS Model fabricated from rolled sections of riveted construction . . . Both Models available with recommended companion twin-hook Car Shakeout Hoist.

Patent No. 2,504,789

HEWITT-ROBINS INCORPORATED

HEWITT-ROBINS

DIVISIONS: HEWITT RUBBER • ROBINS CONVEYORS • ROBINS ENGINEERS • RESTFOAM®

and Never Missed a Day!

Customer's Performance Record

EQUIPMENT: Hewitt-Robins Heavy Duty Car Shakeout.

LOCATION: Bradford Dock of the Carbon Fuel Company, Kanawaha River, Marmet, W. Va.

OPERATION: Unloading coal from hopper cars.

PERFORMANCE: This Hewitt-Robins Heavy Duty Car Shakeout unloaded approximately 50 cars a day, every day for 6½ years without missing a complete day . . . unloaded a total tonnage of 3,207,708 tons . . . average unloading time of 2½ minutes per car under normal conditions (even partially frozen coal unloaded in 10 minutes). During this period of operation, the Car Shakeout has never been torn down and the original shaft, bearings and vibrator assembly are still intact . . . only maintenance required was replacement of V-belts and springs.

RESULTS: The Carbon Fuel Company reports that this unit has paid for itself *many times over in man-hours saving alone.* Now only four men are needed to handle car unloading operations at the dock . . . whereas, six to eight men were normally required before the Hewitt-Robins Heavy Duty Car Shakeout was installed.

CHECK FOR INFORMATION ABOUT THESE JOB-TESTED PRODUCTS FOR YOUR OPERATION

CONVEYORS:
- ☐ —Belt
- ☐ —Dock
- ☐ —Sectional
- ☐ —Vibrating

BELTING:
- *☐ —Elevator
- *☐ —General
- *☐ —Rayon
- ☐ —Woven Wire
- ☐ BUCKET ELEVATORS
- ☐ IDLERS

SCREEN CLOTH:
- ☐ —Electrically Heated
- ☐ —General
- ☐ VIBRATING SCREENS

HOSE:
- *☐ —Air
- *☐ —Fire
- *☐ —Flexible Rubber Pipe
- *☐ —Pinch Valve
- *☐ —Servall®
- *☐ —Steam
- *☐ —Tw'n-Weld®
- *☐ —Water
- ☐ MECHANICAL FEEDERS
- ☐ STACKERS
- ☐ CAR SHAKEOUTS

TRIPPERS:
- ☐ —General
- ☐ —Dust Seal
- ☐ BELT CLEANERS
- ☐ CRUSHERS
- ☐ STOCKING & RECLAIMING SYSTEMS
- ☐ DESIGN AND CONSTRUCTION OF COMPLETE MATERIALS HANDLING SYSTEMS

*For immediate information about these industrial rubber products, call your Hewitt Rubber Distributor (See "Rubber Products" Classified Phone Book).

Hewitt-Robins Incorporated
666 Glenbrook Road
Stamford, Connecticut

NAME _____

TITLE & COMPANY _____

STREET ADDRESS _____

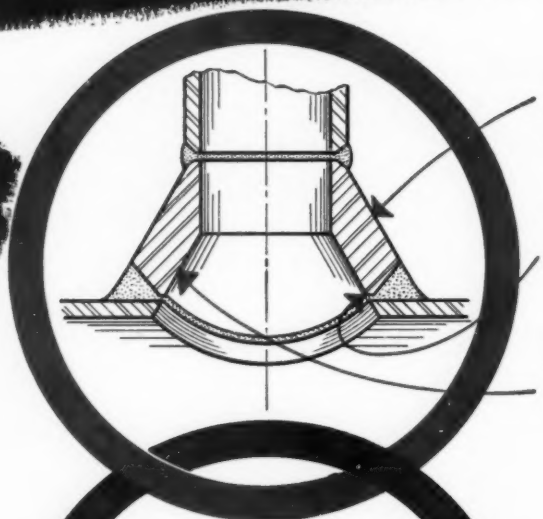
CITY _____ PO ZONE _____ STATE _____

290A

INCORPORATED

EXECUTIVE OFFICES: STAMFORD, CONNECTICUT

Engineered Reinforcement Against CORROSIVE ATTACK at Branch Connections



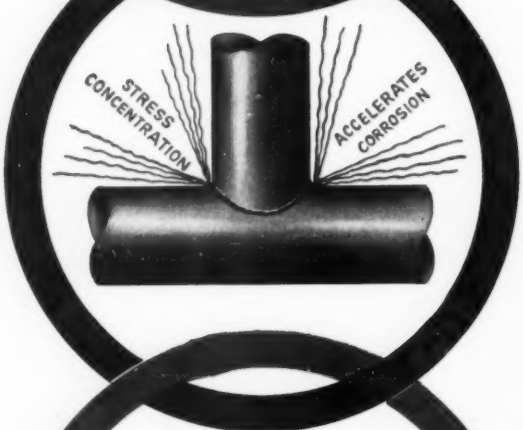
Designed with thick, tapered section to relieve stress concentration.

Additional metal prevents branch connection from corroding dangerously thin.

Funneled inlet relieves stress concentration at point of highest magnitude—the *inside* of the crotch.

Accelerated corrosion due to stress concentrations can be readily eliminated . . . by using WELDOLET WELDING FITTINGS at all 90° branch connections.

When corrosion exists in a piping system, it attacks the points of stress concentration most severely. WHY DOWN-RATE YOUR PIPING SYSTEM BECAUSE OF THIS WEAK LINK?



SPECIFY AND USE . . . . . BONNEY WELDOLET WELDING FITTINGS to insure 100% pipe strength at branch connections under corrosive conditions.

WeldOlets, butt-welding

ThredOlets

WeldOlets, socket-welding

FOR COMPLETE ENGINEERING DATA WRITE FOR YOUR BONNEY W-3 CATALOG

DISTRIBUTORS IN PRINCIPAL CITIES

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

ENG. DEPT., 350 GREEN STREET
ALLENTOWN, PENNSYLVANIA

H-Bombs Versus Common Sense

THE AMERICAN PUBLIC has never recovered from its original confusion about the atom bomb—what it will and won't do. And now we enter a new era of H-bomb confusion.

Our fuzzy thinking springs from too much rhetoric and not enough arithmetic and geometry. If we would think in terms of circles and maps, atom bombs and H-bombs would be as easy to size up as the family car.

Here's how, using the original atom bomb as a yardstick. Its energy equals 20,000 tons of TNT. Call it the 1-power bomb.

For a practical knowledge of nuclear weapons, pick out a map of some major American city or imagined industrial target area. To the scale of this map draw a circle 2¼ miles in diameter—four square miles.

Center this circle on some likely-looking spot for an enemy bomb burst. Figure that everything in the circle is either destroyed or heavily damaged. Estimate the military value of the people, structures and equipment in the area. Do the same for other possible targets. List them in order of their importance.

Imagine the enemy doing just this for the whole of the United States. He'd come up with a list of top-priority targets.

If he works down from the top of this list until his limited supply of atom bombs is exhausted, he will get the most for his bomb money—the greatest total value enclosed by the circles of destruction.

If you make this study on the map of any large city, you will see at once that no sensible enemy would attempt complete destruction of a major city with atom bombs. That would be suicidal—would waste most of his precious bombs on low-priority commercial, industrial and residential districts. He would aim, rather, to wipe out certain carefully selected 4-square-mile circles, certain limited areas of major importance to him.

So much for atom bombs. Now for the question on everybody's lips, "What about the H-bombs, particularly the H-superbombs?" The answer is that they may be less attractive than you think. Why? Because larger bombs are doubly inefficient. First, they destroy less area per unit of power. Second, there are no suitable targets.

To test this statement consider the largest H-bomb anybody has yet had the nerve to suggest, one of 1000 power, equaling 20,000,000 tons of TNT. This bomb would be nowhere near 1000 times as destructive—in fact, only 100 times as destructive, since area destroyed goes up as the square of the cube root of the bomb's power.

Thus the area of its circle of destruction would be 400 square miles (a 22-mile circle), not 4000. *The standard atom bomb is ten times as efficient as this super H-bomb in applying the energy it releases to destroy area.*

Even that is only half the story. Having achieved a certain area of destruction with this very low efficiency, the big bomb can't find a suitable target anywhere in the world. *Where can you find a 400-square-mile circle solid full of number-1 strategic target material?*

Combining these two inefficiencies you'd generally find that about ten "model-T" atom bombs, properly placed, could accomplish as much of military value as a single 1000-power H-bomb.

There isn't room here to discuss other important angles, such as the reduced number of planes required by the bigger bombs and the reduced need for bombing accuracy.

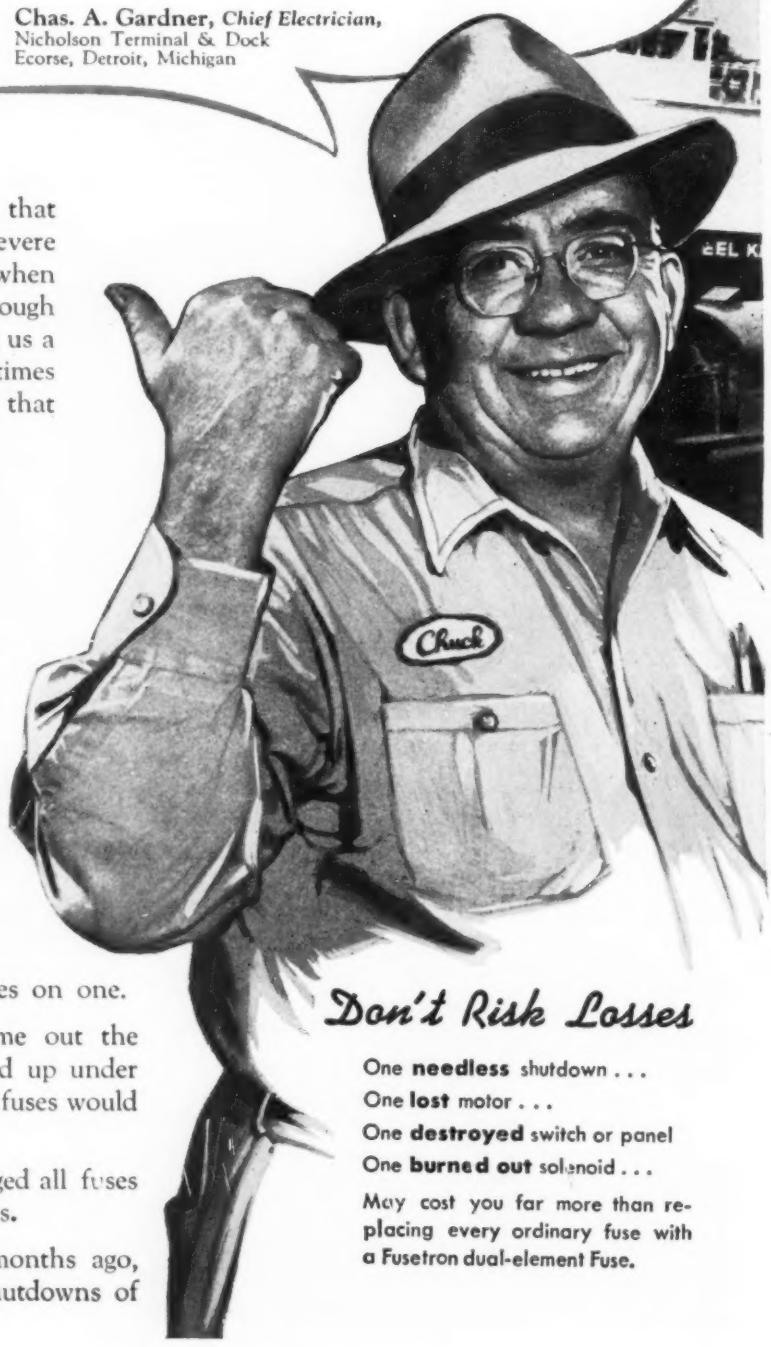
After making all allowances for such factors that may somewhat favor the larger bombs, the conclusion is unavoidable that the nuclear explosive needed for a 1000-power H-bomb would do far more damage to an enemy if divided among a fair number of less powerful H-bombs. You don't use a sledge hammer to kill a few fleas.

And perhaps even the ordinary A-bombs may be the most economical in many cases.

We hope POWER readers will pardon all this cold-blooded arithmetic. We are fully aware of the human implications of the bombs, and very much concerned. But we do feel that all of us, as engineers, must first understand the nature of atomic weapons if our opinions regarding their use are to be worth a whoop.

"WE TRIED FUSETRON DUAL-ELEMENT FUSES ON OUR CRANE MOTOR CIRCUITS . . . THEY REDUCED FUSE BLOWS FROM FOUR OR FIVE A DAY TO ONLY THREE IN SEVEN MONTHS"

Chas. A. Gardner, *Chief Electrician,*
Nicholson Terminal & Dock
Ecorse, Detroit, Michigan



PROBLEM

"We have many overhead cranes that operate on 24 hour schedules. The severe service to which these cranes are put when loading and unloading ships throws a tough load on the motors. This was causing us a lot of grief due to fuses blowing 4 or 5 times a day. Each blow caused a shutdown that stopped work and made men idle.

SOLUTION

"In testing Fusetron fuses to see if they would help us, we selected a certain crane and inserted Fusetron fuses in that circuit for one 8 hour shift. At the end of the shift we would replace the Fusetron fuses with the ordinary renewable fuses we had formerly used. Then we compared the down time of the crane due to fuse blows.

"To be sure the fuse blows weren't due to the operator, we changed around and would run the Fusetron fuses on two shifts and the old fuses on one.

"The results, however, always came out the same. The Fusetron fuses would stand up under the hard service — and the ordinary fuses would not.

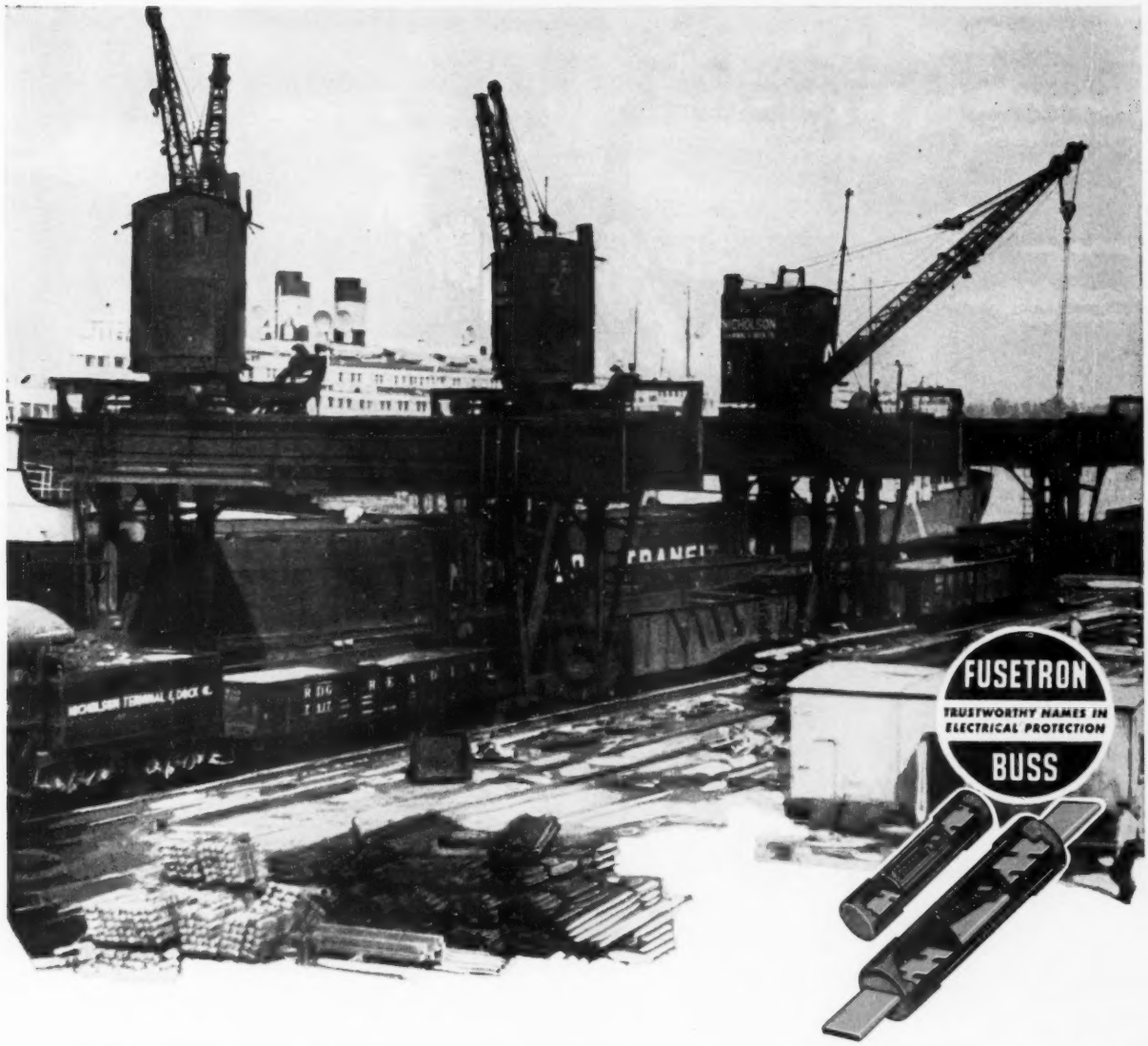
"As a result of these tests we changed all fuses on our crane circuits to Fusetron fuses.

"That was last October, seven months ago, and to date we have had only 3 shutdowns of our cranes due to fuses blowing."

Don't Risk Losses

One **needless** shutdown . . .
One **lost** motor . . .
One **destroyed** switch or panel
One **burned out** solenoid . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.



FUSETRON dual-element FUSES Protect Production *10* Ways

1 *Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.

4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York.

HERE'S WHY...

A fuse link combined with a thermal cutout — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to same dimensions as ordinary fuses, FUSETRON FUSES fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

FUSETRON is a trade mark of the Bussmann Mfg. Co.

Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name_____

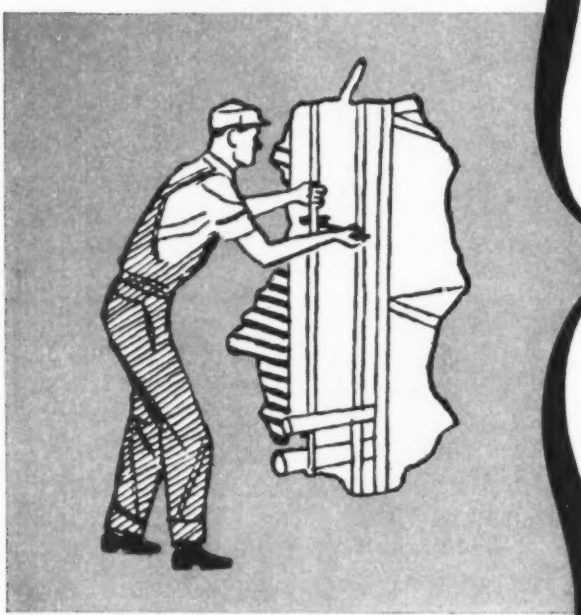
Title_____

Company _____

Address _____

City & Zone_____ State_____ 353

Pipe Repair Jobs...



PLUMBER — $2.84 PER HOUR

MASON — $3.13 PER HOUR

CARPENTER — $2.63 PER HOUR

PLASTERER — $3.08 PER HOUR

PAINTER — $2.57 PER HOUR

add up to just one thing...

CORROSION COSTS YOU MORE THAN WROUGHT IRON

There's nothing like a repair job to point up the false economy of installing low-first-cost piping. The original installation is quickly made by a pipe fitter, but the replacement calls for hours of work by as many as five crafts, all carrying a high price tag. This first failure may wipe out initial savings, a dozen times over. And loss in production or utilization during shutdown may amount to far more than the maintenance charge.

It all adds up to one thing—*corrosion costs you more than wrought iron.*

In literally thousands of applications where corrosion is a threat to service life, the use of Byers Wrought Iron pipe is the soundest kind of economy move. This material's greater durability, proved in past service records, is curbing high maintenance and repair costs in a wide variety of industries.

The next time you approve or specify pipe, investigate the superior performance of Byers Wrought Iron pipe. Remember, it takes only ONE to *install* pipe, but FIVE to *repair* it!

You'll find a lot of helpful information on the control of excessive maintenance in our bulletin, WROUGHT IRON FOR PIPING SYSTEMS. Write for your copy.

Labor costs shown above are estimated national averages according to Bureau of National Affairs, Inc.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N.Y.

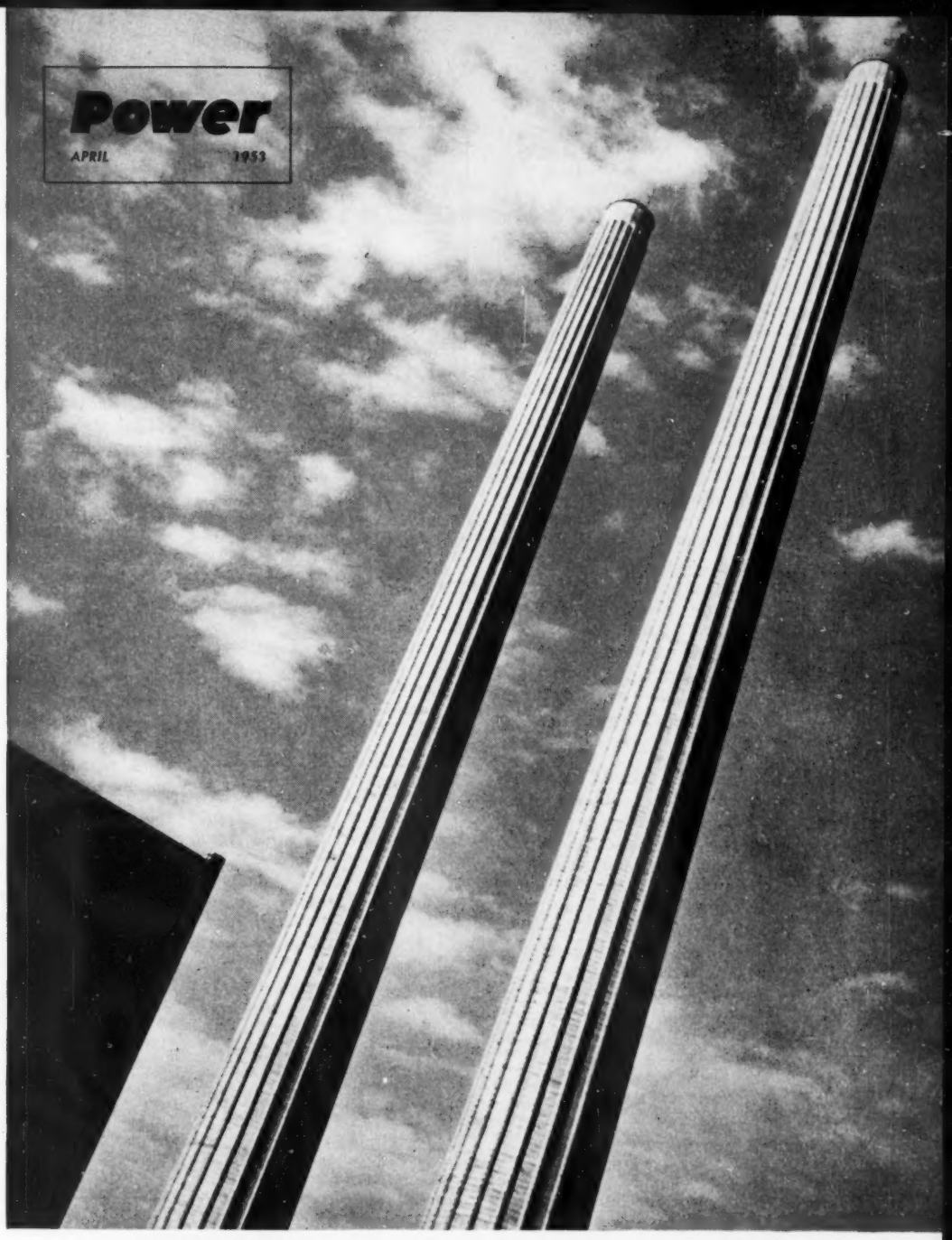
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

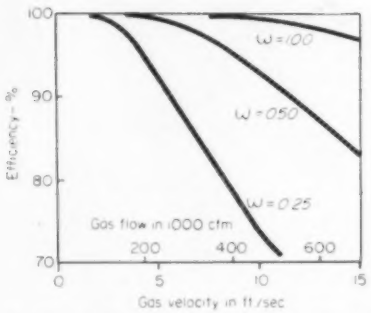
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



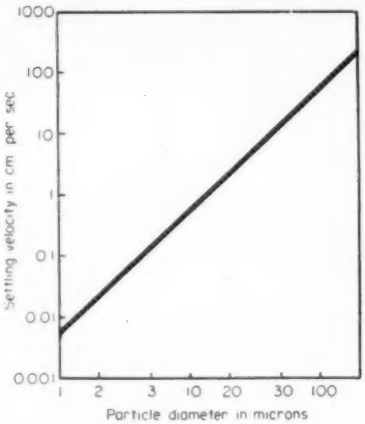
CLEANER STACKS owe their development to better combustion, dust-collecting equipment

Battle Report on Pollution Control

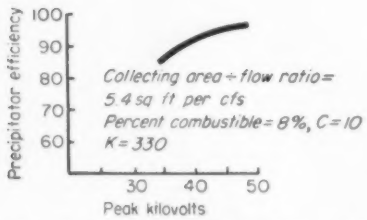
Public reaction to air pollution problems has become so inflamed that the solid progress of plants and equipment manufacturers in bringing power boiler-stack headaches under control has been overlooked or glossed over. For an encouraging report, turn page . . .



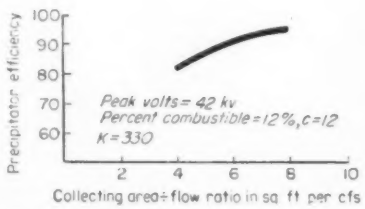
1 Gas-flow rates, plus drift velocity of particles, influence final results



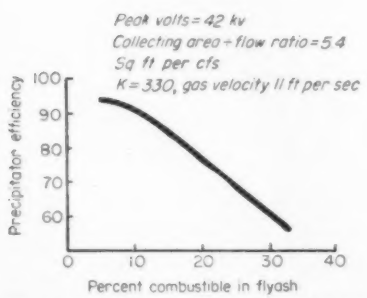
2 Settling velocity of particles has long been used to rate precipitators



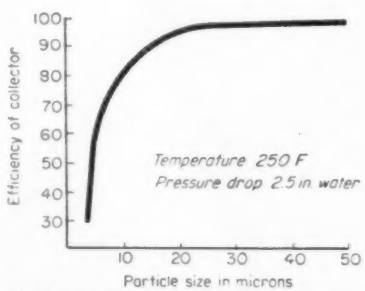
3 The higher the applied voltage, the more efficient will dust collection be



4 Ratio of effective collecting area to gas flow affects unit efficiency



5 Combustible content of flyash above 10% destroys precipitator results



6 Mechanical dust collectors show good results for certain particle ranges

Constant Study . . .

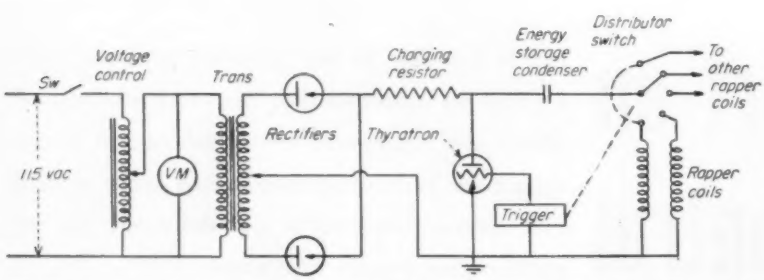
► COMBUSTION OF FUEL of any kind—solid, liquid or gaseous—always gives off waste products that could be pollution problems. Some, like carbon dioxide and water vapor, vented to the open air and adequately diffused, prove harmless. But to the untrained eye the steam plume they form appears threatening. This public reaction to stack discharges makes the job of removing the objectionable elements that much tougher.

One of the biggest targets for public reaction to air pollution is the large central-station power plants. Yet, as a class, they usually prove willing to spend more in solving power-generating and allied problems than other industries. And this instance proves no exception. What, then, is the case* for air pollution today? On the whole it's highly encouraging.

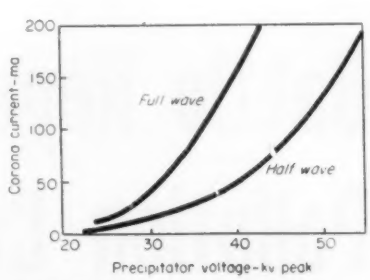
Air-Borne Solids. The major problem, as the utility industry sees it, is and has been control of air-borne solids. Remember, they burn tremendous quantities of pulverized coal—over 105,000,000 tons in 1951 alone. Assuming an average ash content of 10% this could, without due precautions, show up as about 10,000,000 tons annually of flyash.

But to get the problem down to more practical proportions—the single plant—consider a large modern boiler of 1,000,000-lb-steam-per-hr capacity. It exhausts flue gas at about 500,000 cfm at a temperature of 300 F or so. With a typical, average figure for flyash con-

*Abstracted from the following papers: *Air Pollution Prevention in Electric Generating Stations*, H A Bauman, Consolidated Edison Co, AIEE Paper No. 53-27, and *Electrostatic Precipitators for Electric Generating Stations*, by H J White, Research Corp.



7 Continuous rapping of collector electrodes in an electrostatic precipitator by magnetic means removes dust deposit without previously usual objectionable puffs



8 Predicting corona voltage - current varies with each different flyash

. . . And Field Research Have Upped Performance of Dust Collectors

centration of 2 gr per cu ft, dust leaving this furnace amounts to about 140 lb a minute, or 100 tons per day. A sizable control problem for any plant. Yet there is equipment today that does a 98% efficient clean-up job of this stack dust.

Particle Size. Solid particles, making up stack dust can and do range in size from the tiniest specks, too small to be seen in a powerful optical microscope, to particles large enough to pick up with the fingers, Table II, p 76. The very small particles represent no problem except under most unusual conditions of concentration. The large ones can be reduced in quantity both at furnace and at stack level. Upper limit of this reduction has been set in many cities by ordinances regulating smoke and dust.

A large percentage of these ordinances draw on *ASME* Test Code PTC 21-1941, which states a maximum figure of 0.85 lb per 1000 lb gas (equivalent to about 0.3 gr per cu ft at 300 F) adjusted to 50% excess air. If left to a clean-up at stack level alone, this would require a collector of 85% efficiency for the average flue-dust load—well within current design limits (see below).

Furnace Performance. But the utility industry does not leave the clean-up job to the stack alone. They've thoroughly investigated furnace conditions and performances with an eye to reducing the problem before it gets a start.

Complete combustion is a basic requirement with the large, better-run central stations. They take every precaution for obvious reasons of economy: to assure (1) proper fuel preparation (2) intimate mixture of air with fuel (3) correct introduction of fuel to furnace (4) furnace of adequate design for fuel in question (5) ample fan capacity for required excess air (6) constant maintenance of proper fuel-air ratios (7) mechanical or electronic aids to correct and signal faulty furnace conditions to operation. These seven steps represent the best engineering practices in assuring complete combustion.

Over and above instituting these correct operating steps the role of individual fuels and furnace designs have received similar intensive study. The more progressive companies take every advantage of facts like these—slag-tap furnaces can drain off a portion of the fuel ash in a fused form; other furnace designs may separate out varying proportions of ash from the flue-gas stream; fuels of low solid residue result in lowest gas dust-loading. Just about every known way of holding down dust loading at the furnace level can be found in use or under study. A reduction in the carbon percent in flyash (preferably below 10%) is very desirable for cleaning both at furnace and stack level.

Stack Level Clean-up. The same attention to performance details carries over into the methods for collecting flue dust after it leaves the furnace. Hence, dust-collector manufacturers have been steadily raising their equipment's performance levels in response to this demand. POWER, special reprint, *Clean Air*.

Both mechanical and electrical designs report efficiencies up to 90% and, in some instances, better. A recent electrostatic precipitator design installed at Goudey Station of New York State Gas and Electric Co is said to give 98% efficiency handling 253,000 cfm of 264-F gas from a 560,000-lb-per-hr generator. Dust loadings run from 3.43 to 2.33 gr per standard cubic ft. Moreover, this unit features a new method for continuously cleaning off the collecting electrodes. But let's review precipitator theory first, to better understand these improvements.

Theory. In practice, gas containing particles of dust in suspension passes between highly charged electrodes of the typical electrostatic precipitator. While under the influence of these electrodes electric forces act on the particles to force them onto collecting plates or surfaces. Under usual conditions the charge on a 10-micron-dia particle (1/2500 of an in.) is about 25,000 electrons, while the precipitating or collecting field measures about 4500 v per cm. The coulomb force amounts to about 300 times the gravitational force, assuming a spherical particle of unit density. So it is by far the dominant element.

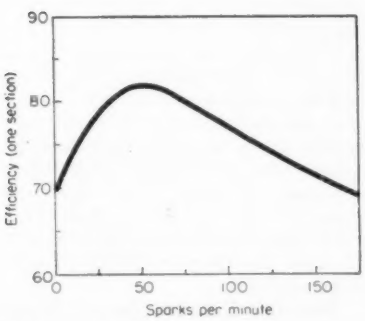
The efficiency of particle removal, though, depends mostly on the effective surface area of the collecting electrodes, the gas-flow rate through the precipitator and drift velocity, w, of the charged particles in the electrical field. In turn, w is directly proportional to the particle radius so large particles collect at a faster rate than do fine ones.

Fig. 1 graphically illustrates the swing of precipitator efficiency with gas flow for several values of w. Efficiency runs high at low gas rates for all values of w and falls off with increasing gas flow, slowly for high values of w, more rapidly for low.

The effective theoretical value of w for flyash precipitators is about 0.7 to 1.2 ft per sec as against the practical and field efficiency measurements of 0.4 to 0.6 ft per sec. This 2 to 1 discrepancy can be charged to the loss of precipitator performance caused mostly by uneven gas flow and loss of particles from collecting surfaces by resuspension.

From a practical application point the precipitator manufacturer needs data on the properties of furnace gas and dust. For example, the corona and the sparking characteristics that determine the strength of the electric field, its coulomb force, depend on dielectric properties of the gas and resistivity properties of the dust. A typical pulverized-coal-furnace gas after the preheater consists of 77% nitrogen, 4 to 5% oxygen, 12 to 15% carbon dioxide and 4 to 10% water with traces of sulfur dioxide and trioxide. Table I shows the makeup of a typical dust. From such data, gas properties and resistivity can be determined.

Furnace-gas moisture content and dewpoint are primarily influenced by the amount of volatile matter in coal. They, in turn, strongly influence corona and electrical operating characteristics. Trace quantities of sulfur trioxide are



9 Research shows sparking is good in precipitators but only up to a point

Complete flue-dust data, next page, should accompany specs

I: Chemical Composition Of Flyash

Element	Percent
Carbon as C	0.37-36.2
Iron as Fe_2O_3 or Fe_3O_4	2.0-26.8
Magnesium as MgO	0.06-4.77
Calcium as CaO	0.12-14.73
Aluminum as Al_2O_3	9.81-58.4
Sulfur as SO_3	0.12-24.33
Titanium as TiO_2	0.50-2.8
Carbonate as CO_2	0.05-2.6
Silicon as SiO_2	17.3-63.6
Phosphorous as P_2O_5	0.07-47.2
Undetermined	0.08-18.9
pH value	4.7-11.7

II: Particle Size Distribution for Representative Flyash Samples, in Microns

Sample No.	0.5	5-10	10-20	20-44	Total smaller than 44	Total greater than 44
1	25.0	16.6	18.5	26.0	86.1	13.9
2	32.3	16.5	12.8	2.6	64.2	35.8
3	39.1	16.8	24.0	16.8	96.7	3.3
4*	83.6	5.1	3.2	2.3	94.2	5.8
5	54.8	26.5	9.1	0.7	91.1	8.9
6**	64.0	16.1	2.1	0.1	82.3	17.7
7***	—	—	—	—	2.9	97.1
8	—	—	—	—	59.3	40.7
9	—	—	—	—	95.4	4.6

*Same as sample 3, but taken at outlet of installed mechanical collector
**Cyclone-type furnace ***Stoker-fired furnace

AIR POLLUTION *continued*

credited with the ability to raise dewpoint temperatures considerably. So precipitator design must give proper weight to flue-gas properties and be capable of best operation at a temperature well above dewpoint to avoid corrosion problems.

Particle size and shape, Table II, also play a part in precipitator effectiveness. The translucent, hollow spheres present in most flyashes range from below 10 microns up to 44. The irregular-shaped carbon particles commonly called grit, resulting from incomplete pulverized-coal combustion, can be anywhere from 10 to over 300 microns in size. Their shape varies from slivers to highly irregular sponge- and lace-like material. And their density proves low, about 0.7 against the average flyash specific gravity of 2.0 to 2.7.

Fig. 2 shows the settling velocity for a spherical particle of 2.2 density in a gas temperature of 300 F, and illustrates the striking decrease in settling rate with smaller particle diameters.

Resistivity. As these particles are pulled out of suspension they build up on the electrode surfaces to form layers averaging ⅛ to ½ in. thick. The corona current from the high-tension wires has to pass through these layers to reach the grounded collecting plates. When the resistivity approaches the critical value of $2x10^{10}$ ohm/cm, sparking grows more intensive and performance falls off. Normal resistivity level, though, ranges between 10^8 and 10^{10}-ohm cm.

But certain chemical compounds, in small quantities, act as conditioning agents. They are, however, specific for each dust, and the proper one for any new dust type is found only by trial. Research Corp over the years has disclosed and confirmed that sulfur trioxide in the quantities normally present in boiler gas serves as a conditioning agent. It holds bulk resistivity below the critical $2x10^{10}$-ohm cm level.

Specifying Precipitators. With all the considerations including the above that go into good precipitator design, this information is basic in specifying this equipment: (1) desired collection efficiency (2) normal gas flow or cfm rating (3) maximum gas flow or cfm rating (4) steam flow or boiler-load rating (5) gas temperature at the precipitator (6) permissible precipitator draft loss (7) type of coal and percent ash (8) particle size and maximum percent combustible expected in ash (9) furnace and burner types (10) air preheater design (11) precipitator location in power station (12) layout of connecting gas flues.

Let's see, now, how well modern electrostatic collectors meet design needs.

Operating Problems. Even with the above basic requirements known, electrostatic precipitators in years past suffered from some relatively small but annoying operating problems. Chief among them were cleaning of collected dust from electrodes, determining the ideal operating voltages and currents, achieving effective and adequate energization. Latest designs, like the one at Goudey Station, go a long way toward solving these problems.

Continuous Rapping. Intermediate system of rapping electrodes, employing mechanical or pneumatic vibrators to clean off collected dust, reduces over-all efficiency at cleaning time by only 2 to 3% or less. Yet the puffs this method gives off cause some public concern. So the equipment makers have had to devise a method of continuous cleaning of collecting electrodes.

They've done this with a magnetic impulse rapper system based on electric and magnetic principles, free of the objections of the earlier pneumatic or mechanical approaches. A steel plunger serving as the armature of an electromagnet delivers the rapping action. A thyratron tube and distributor switch times and controls the impulsive discharge of a condenser to excite the magnet's solenoid coil. Both intensity and frequency of rapping can be adjusted by varying the condenser voltage.

From still another practical, operating point — maintenance — this rapper unit has a decided advantage. There is only one moving part, hermetically protected against atmospheric dirt and corrosion, and permanently lubricated at the time of manufacture. Designers claim it is now possible to maintain a clean stack at 98 to 99% efficiency with no trace of puffing or clouding and at high reliability.

Operating Voltages. Industrial precipitator performance proves superior

(*Continued on page* 196)

Today's Designs Cut Process-Pump Costs

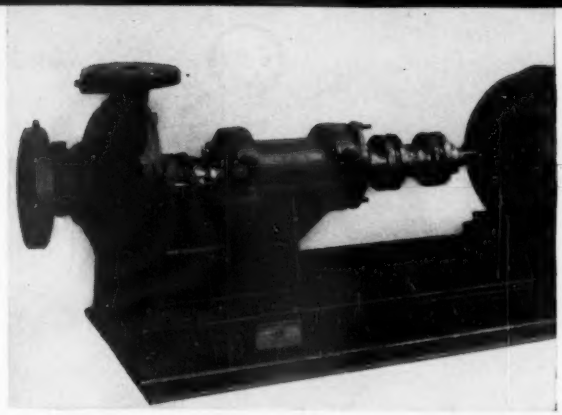
By E G HILFICKER, *Design Engineer, Economy Pumps, Inc*

► CENTRIFUGAL PUMPS in process industries must do so many different jobs that manufacturers are carefully considering parts standardization wherever possible. Interchangeability reduces repair-parts stock, gives the pump far greater versatility.

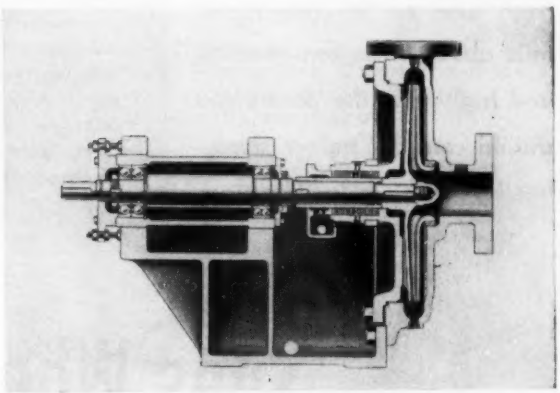
Modern Designs. Photos show some advantages gained by pump standardization. By simply changing volute covers, pump can be fitted with a cooled instead of a noncooled stuffing box. You can also change from a closed to a semi-open impeller without extensive work.

Spacer-type couplings allow removal of entire rotor after spacer is disconnected. Screws permit operator to adjust impeller position axially. Rotor servicing is simple.

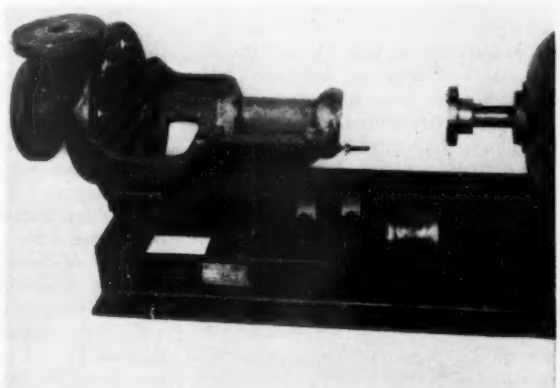
Other innovations include a single, confined casing gasket, compact cartridge-type bearing housing, oversize bearings to extend the pump's usefulness, and a gland collecting chamber that eliminates need for a drip pan. Pump manufacturers are devoting much time to study of process problems and you can expect many developments in the future.



GENERAL SERVICE process pump has spacer-type coupling for easy rotor removal. Special screws adjust the rotor axially

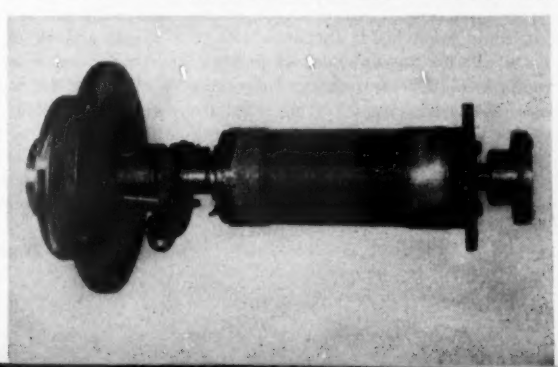


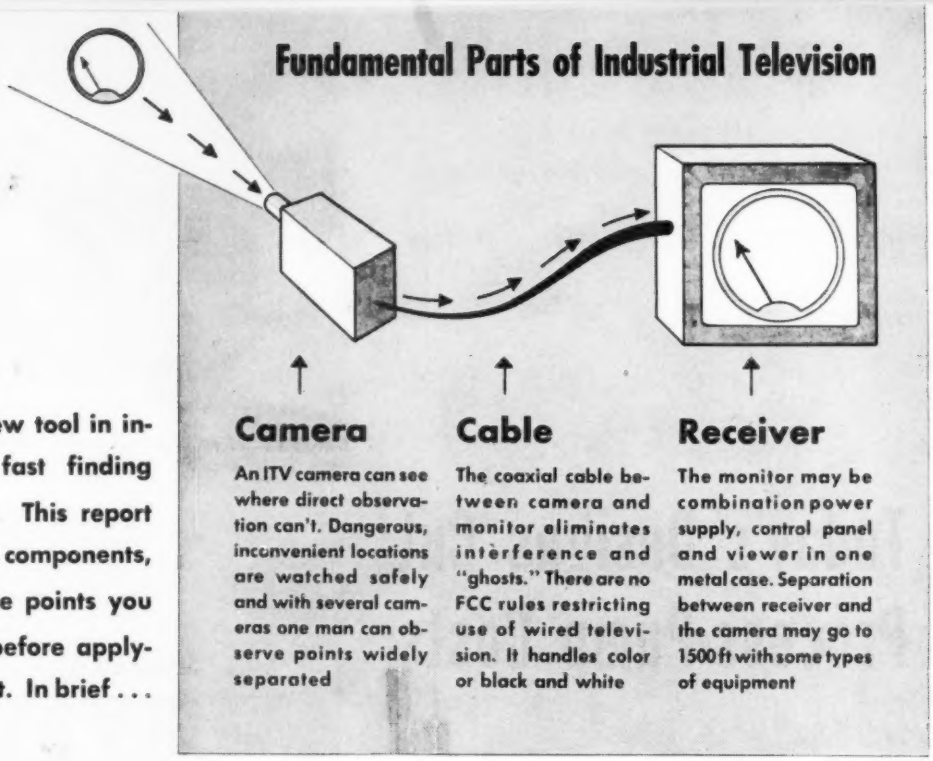
SECTION through general-service process pump. This unit can handle liquid to temperatures of 350 F, has replaceable parts



PUMP CASING and bearing housing bracket are undisturbed when rotor is removed. Complete rotor assembly is easily lifted

ROTOR ASSEMBLY after being lifted from pump casing. Unit is compact, has completely enclosed double-row ball bearings




Fundamental Parts of Industrial Television
Camera
An ITV camera can see where direct observation can't. Dangerous, inconvenient locations are watched safely and with several cameras one man can observe points widely separated
Cable
The coaxial cable between camera and monitor eliminates interference and "ghosts." There are no FCC rules restricting use of wired television. It handles color or black and white
Receiver
The monitor may be combination power supply, control panel and viewer in one metal case. Separation between receiver and the camera may go to 1500 ft with some types of equipment

Industry has a new tool in industrial TV — is fast finding fresh uses for it. This report tells about basic components, and highlights the points you should consider before applying it in your plant. In brief . . .

TV Sees Where You Can't Look

► ACCORDING TO TOP TV experts, industrial and scientific television may easily become more important and be used more extensively than television in the home. Industrial television (ITV) is essentially a private form of telecasting for a specific, selected audience. It has certain definite advantages over broadcast TV.

To begin with, there is no need for FCC license to install or operate. ITV is carried by coaxial cable between camera and monitors, and not broadcast in the public domain. There are certain technical advantages, such as being able, if necessary, to send better color or black-and-white images. Although present use of ITV is only a small fraction of what it will be some day, there are already many applications.

Three common power-plant uses are checking on smoking stacks, monitoring water level in boiler-drum gages, studying combustion inside furnaces.

Outside the power plant, we find hospitals using ITV to telecast operations over a closed circuit. Railroads are testing television as an aid to switching cars, checking on incoming and outgoing trains. Police in Houston, Texas, have experimented with it to check on the conduct of lawbreakers in jail cells.

A London airport is starting to use ITV in conjunction with radar to check on aircraft traffic, both on the field and in the air. Television has witnessed contract signing, with signatories long distances apart. With wired television, sales departments of large industrial companies have conducted "meetings" between salesmen and sales managers, stationed in several cities.

By telecasting educational, scientific and other conferences to overflow audiences, ITV serves the interests of universities. The British used it to advantage recently in salvaging a submarine, lost with 75 men aboard. Salvage workers carried a TV camera in a watertight compartment. When they located the sub, viewers on surface could even read the name on the prow. In exploring volcano craters, crevices, mine shafts—any place difficult to reach because of depth, pressure, lack of space, etc—ITV can literally see where you can't look.

Back in the industrial field, we find that supervising plant operations is a growing part of the ITV job. Actual manufacturing is another part. For instance, a blast-furnace operator can now get a much closer look inside the furnace. Previously, intense heat prevented him from seeing what was going on.

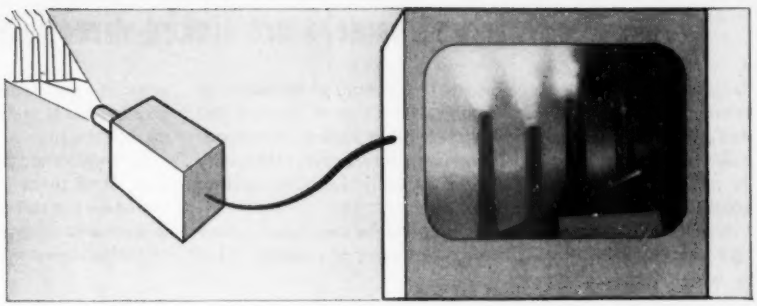
Another important use is industrial-plant security. Cameras spotted in strategic places relay their pictures to central viewing points. One guard can effectively watch many parts of the plant at the same time.

In the field of atomic energy, 3-dimensional television, *stereo*, is of major importance. Atomic-energy installations call for working with dangerously radioactive materials. Scientists can work with such materials behind protective barriers, using mechanical hands and the eyes of ITV.

The problem of remote vision has intrigued industry for many years. In the past when line of sight from gage glass to operator was obstructed, he used mirrors to bring the reading into view. But since the size of an image decreases as distance increases, and since it's a problem to provide a straight line-of-sight between mirrors, they have their limitations. Of course, operations can be monitored indirectly by metering critical measurements. But it remained for industrial television to bring the subject in full view of the observer, regardless of the distance between them.

SMOKE

Televised picture of actual smoke guides operator in the control or boiler room



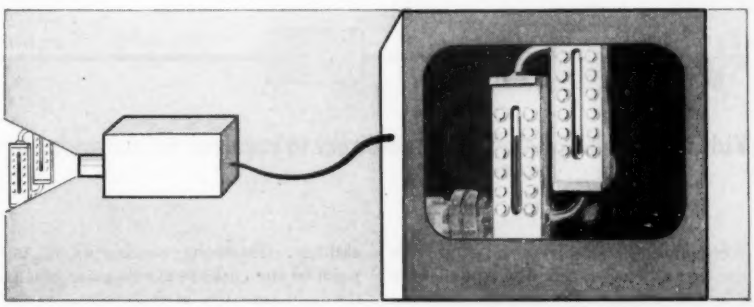
Current interest in smoke abatement, plus the inherent interest of the power engineer in higher plant-operating efficiency, has opened up the field of smokestack observing to ITV. By simply training a camera on plant stacks, the operator readily sees the degree of smoking and guides himself accordingly. This method means the old-time smokewatcher can be put to more useful work around the plant.

In all sketches, both above and below, only the video signal circuit is shown. But the complete installation calls for a camera, power supply and viewer or monitor. Units are connected through a coaxial cable.

When locating the camera, provision must be made for a watertight outer compartment. Viewer may be stationed above the firing aisle within the power plant.

WATER LEVEL

Television sends a picture of boiler-water-level gage direct to control room



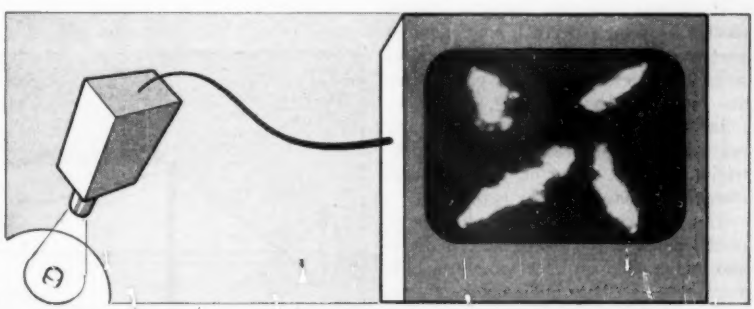
ITV has outdated the mirror method of keeping check on water level in drums. Whether ITV is more effective than modern water-level-indicating instruments is open to question. But it has one obvious advantage over any other form of remote signaling in that it gives either a correct indication or none at all. It will always fail safe.

Which of the several methods of keeping tabs on boiler-water level is used in any given case will depend to a large extent on local installation conditions—distances, obstructions between drum and observation point, etc. ITV forms another, and flexible, solution.

Increased boiler height often makes transmission distance up in the region of 250 ft. Auxiliary lighting must often be maintained at camera location.

COMBUSTION

Camera checks firing from a mounting atop boiler, cuts the hazards of lighting-off



Before lighting off, the operator can see the ignition torches on screen in the control room. He sees at a glance that all torches are lighted. Four white areas shown in monitor, above, are the ignition torches.

In lighting off pulverized coal, the screen blanks out when fuel is first admitted to the furnace. Ignition normally takes place in 30 seconds, then screen brightens.

In the combustion application the camera lens is often protected from the intense heat by a watercooled window. Water from a storage tank is picked up by a motor-operated pump, forced through a small heat exchanger, then through the watercooled window and back to the tank. Another method of camera protection uses air cooling, supplied by about 45 cfm air at 1 psi.

(More on next page)

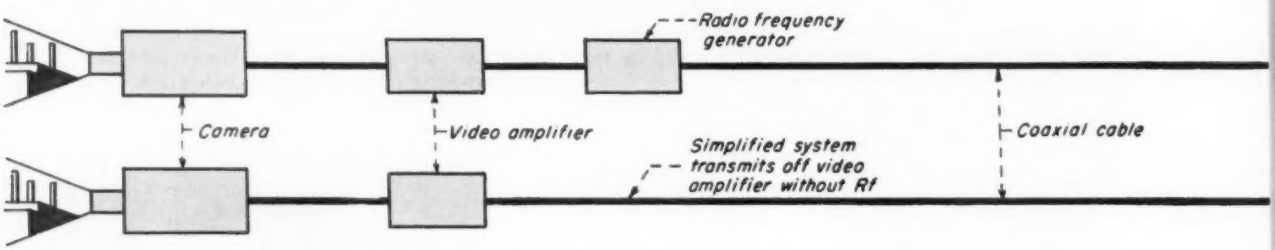
Receiver and camera are linked directly through a coaxial cable . . .

Is industrial television complicated? Compared to home, or commercial, television, no. Commercial TV uses between 750 and 1000 tubes to transmit a picture from studio to receiver. ITV, including camera and receiver, does a job using only 17 tubes in some cases. And it must be designed to operate continuously without attention.

Usually, ITV consists of a camera and its associated power unit, connected by coaxial cable to a viewer or monitor. This monitor is generally in the plant control room. There are no radiated signals, and the setup is called a *wired* or *closed circuit* system.

ITV still needs application engineering for every installation. And there is often need for equipment in addition to the basic television. For instance, special enclosures must be designed to counter extreme conditions of weather, dust and vibration; protective windows are needed for viewing fur-

THE CAMERA collects light rays, translates the visual image into electrical impulses



Video signal may be transmitted direct to receiver as shown in the lower part of the above sketch . . .

When looking at a television picture you are actually observing the antics of a tiny dot of light. But this dot is being deflected both horizontally and vertically on the screen so rapidly that the eye cannot follow its instantaneous position. Instead, the eye sees the effect of the travel. In one second, the dot of light travels back and forth across the screen well over 15,000 times. Each complete picture, or "frame," is made up of between 300 and 525 lines, stroked out by the flying dot.

Basically, television converts light to electricity, which is much more flexible for transmission. When the electrical impulses reach the desired point, they are converted back to light.

In ITV, there are three available camera tubes for converting light into electricity: *image dissector, vidicon* and *image orthicon.*

The image-dissector type has been used longest in the power field; vidicon and image orthicon have come into ITV more recently. Image-dissector camera is essentially a cold-cathode unit that converts light into electricity using cesium-oxide-silver. This material gives off electrons when light strikes it. No special source of electrons or filament heating is needed.

Looking at the sketch, right, note that the light image of the object being scanned is focused on a photoemissive cathode. Electrons coming from any point of the cathode are proportional to the light intensity at that point. At the far end of the tube is a scanning aperture and an electron amplifier. Deflection causes electrons from each portion of the cathode to pass through the aperture in the course of each frame. If a particular area is brighter, more electrons are liberated from the cesium surface and pass through the aperture at the proper instant. The electrons are amplified and sent over the cable as the video signal to the picture tube at the receiving end.

In this highly simplified explanation it isn't possible to go into details as to differences between image-dissector, vidicon and image-orthicon camera types, which operate on roughly similar principles. For full discussions of their operation and construction, see *Television Engineering*, D F Fink, McGraw-Hill Book Co.

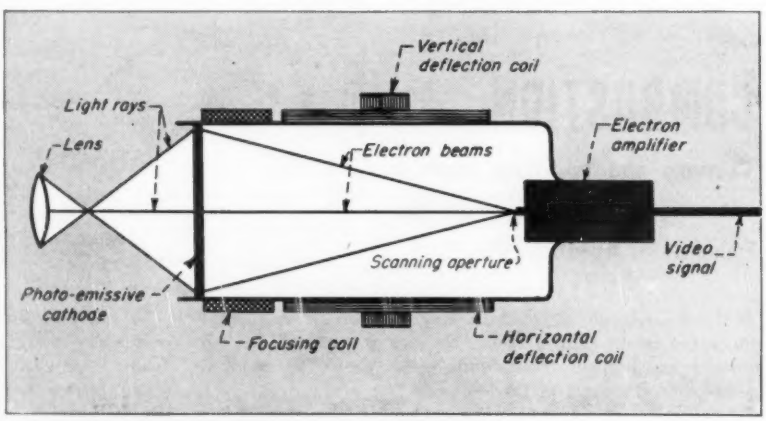


IMAGE-DISSECTOR CAMERA uses photoemissive cathode to convert light rays into proportional-strength electron beams, forming signals sent over coaxial cable

. . . Home-type receivers may frequently be used as duplicate monitors

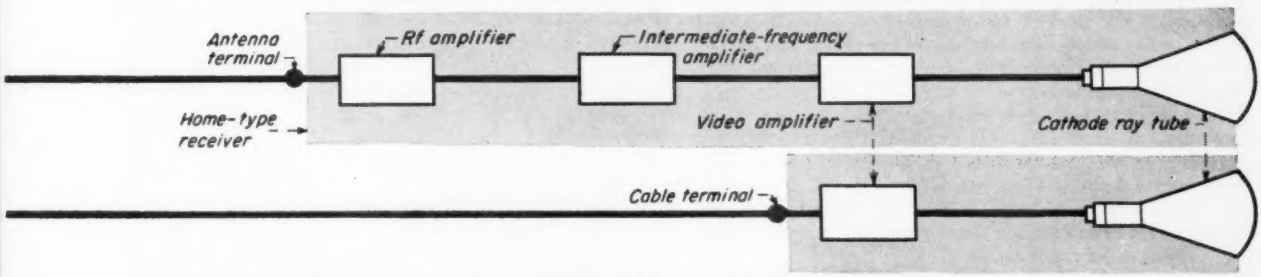
naces. Transversing and elevating mechanisms, supports, mounting facilities must be designed to cope with particular problems found at the installation.

Here, briefly, are the requirements of both camera and picture tube for an ITV setup.

Camera must collect light from the scene, yet preserve general tone and geometry. Then it must translate optical images into corresponding electrical images, breaking them into a succession of electrical values that make up the picture signal. In the receiver, the picture tube must accept the electrical signals and translate them into corresponding values of light, reassembling the light values into a picture before the eyes of the viewer.

Camera and picture tube have three points in common: Each is an electrical device, a photoelectric transducer, and a scanning device.

THE RECEIVER or cathode-ray tube converts the electrical signals to a final picture



. . . or sent through radio-frequency generator, transmitted at rf, top sketch. Both systems now used

The picture tube, sketch below, is also known as a cathode-ray tube (CRT). Neck and fluorescent face are glass, conical section is either glass or metal.

The image you see is swept out on the face by the electron beam, emitted by a heated cathode. To produce a sharply defined picture, electron beam is concentrated by focusing in a suitable electrostatic or electromagnetic field. And to produce a well-lighted picture, the beamed electrons are speeded up by incorporating a highly positive anode between cathode and viewing screen.

To make the beam scan the tube face, "saw-tooth" voltages are imposed on deflection plates. Or saw-tooth currents may be sent to coils to create the electromagnetic field needed for suitable beam deflection.

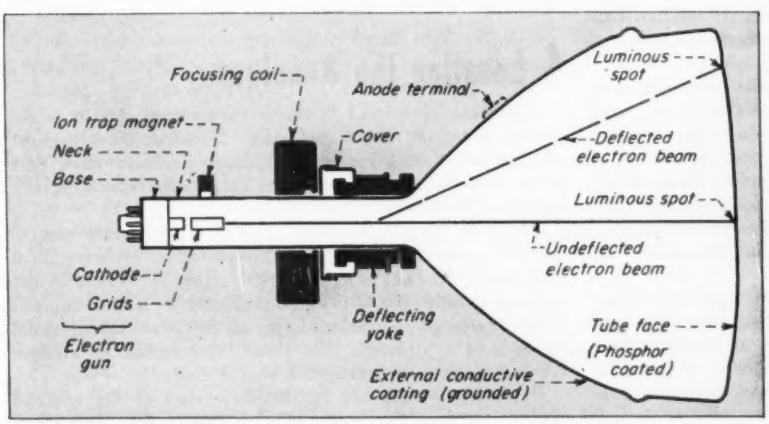
When electron beam strikes the fluorescent screen, the bombarded area gives off light in proportion to beam intensity. Actually, the number of electrons in the beam varies according to the video signal appearing on the CRT grid. The more negative the video signal, the greater the instantaneous bias between grid and cathode, and the fewer the electrons in the beam. The less negative the video signal, the less the instantaneous bias between grid and cathode, and the greater the number of electrons in the beam.

Since beam intensity constantly fluctuates, the amount of light given off by each bombarded area in the screen also varies. As a result, a rapid succession of spots differing in illumination from very light to dark is swept on the fluorescent face. The pattern consequently seen by the observer is the same as the light and shade in the transmitted picture.

The image formed is a reasonable facsimile of the televised subject. Electron beam scans the tube face so rapidly that, because of persistence of vision, the eye sees a complete picture rather than a series of dots.

Cathode-ray tubes should always be handled with care. The glass tube must withstand tremendous force against high vacuum inside. This force (atmospheric pressure multiplied by total area of tube) often reaches half a ton. If tube breaks, dangerous implosion results.

More on next page



CATHODE-RAY TUBE converts the signals to a picture. Electrostatic or electro-magnetic field concentrates electron beam, anodes or grids accelerate the electrons

6 Points to Consider Before Putting TV to Work in Your Plant

Because its eye is unblinking, and special tubes or filters can be used to compensate for unfavorable lighting or glare conditions, you see more with ITV than you could by full-time personal observation. But the equipment needed varies widely according to what it has to do. So let's look at six factors engineers often ask about

1 Color

Wide use of color for ITV seems unlikely at present. Additional expense, added complications of operation, and extra maintenance make currently available color equipment undesirable for use in industry.

In the medical field, however, where color is extremely important, it is worth the added expense. Only intermittent service is required, and conditions are such that delicate TV adjustments will not be disturbed.

Watching furnace operation in color appears attractive at first glance, but considerable development is needed before color TV will serve continuously.

Severe conditions at the camera location, restricted space, additional cost and maintenance, plus need for reliable, continuous service, indicate more rugged black-and-white television for industry.

2 Black and White

As mentioned on the previous pages, there are three basic camera types available for ITV: image-dissector, vidicon image orthicon. Each has distinct features that make it adaptable to one or more applications in the industrial field. Some of the factors an engineer must juggle in selecting a camera and its related system are first cost, life expectancy, picture quality, maintenance.

Two tube types make up for lack of total sensitivity in the image-dissector camera. (1) Cesium-oxide silver (or red) tube is most sensitive to light waves in red and infra-red areas of the spectrum. It picks up a good image of coal or oil flames, is used for general observation. (2) Where subject being viewed gives off blue light, as a natural-gas flame, a cesium-oxide-antimony (blue) tube provides good definition. This tube also transmits a good picture of smokestack emissions, is used for viewing standby oil flames.

Image-dissector cameras scan at 350 lines, picture resolution is 300 lines, not interlaced. (With interlacing, image is alternately scanned in two sets of lines, one between the other.) Auxiliary lighting is usually required, and best results are obtained with 150 to 250 foot-candles illumination. Acceptable picture is ordinarily obtained with 100 ft-c. Because the circuit is different from commercial equipment, home-type receiver will not work with an image-dissector camera, without modification.

Vidicon-tube system has sensitivity and spectral-response characteristics that allow use of standard photographic lens filters. The camera uses any standard 16-mm motion-picture lens with a type C mount. This allows choice of any lens type—telescopic, wide angle, etc, for specific applications at low cost.

Vidicon cameras scan at 525 lines. Picture resolution is 400 lines, interlaced. Scene brightness of 100 ft-c is best, minimum brightness is 50 to 60 ft-c. Standard home-type receivers can be used for auxiliary viewers.

Image-orthicon cameras are used mainly in military installations. Picture quality may be as good as or better than broadcast TV. Image orthicon is used largely for observing precision operations and picking up visual detail in hazardous locations.

3 Locating the Camera

Naturally, camera must be located so it sees what you want to see. This may require special mounting. For a new boiler, ITV location is figured in the original design. This often reduces the cost of installation.

Angle of vision required to cover the scene must be considered, and camera located to give best possible picture. Auxiliary lighting arrangements have to bring scene brightness up to required levels. The lens type is another factor to consider in locating camera for best picture.

Remote-control indexing mountings may be necessary to keep camera at proper position. Where there is excessive vibration you also need shock mountings.

Ambient camera temperature should not exceed about 150 F. And if temperature is too low, lens may fog. So a housing may have to protect camera against weather, dust, corrosive or explosive atmospheres, heat, cold.

Aircooled or watercooled windows keep temperature down when camera is viewing furnaces. Outdoor installation that watches stacks in cold, wet weather may need electric heaters and windshield wipers. Explosionproof housings decrease operating hazards in dangerous areas.

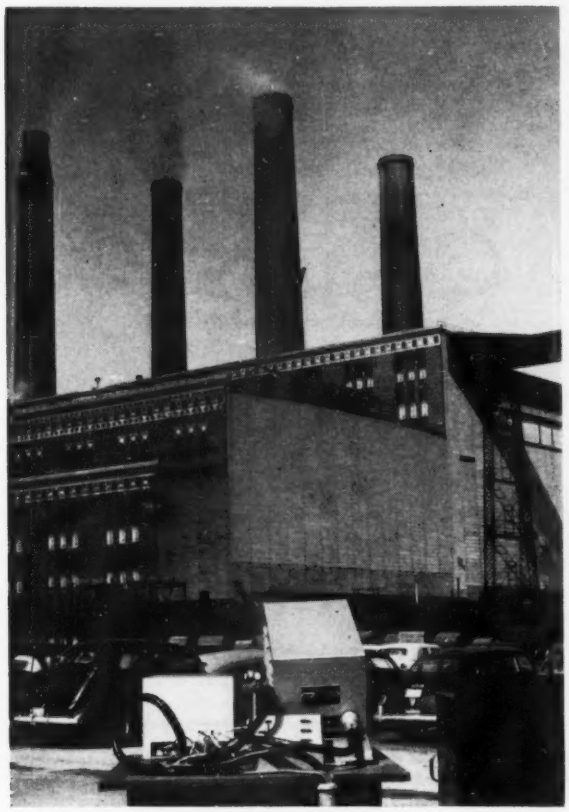
4 Locating the Receiver

The place where an ITV receiver does most good is in the control room, on the control panel. Operator notes changes in gage level, stack emission, or flame condition when they occur, and takes proper steps to keep boiler operating efficiently. There is little time delay.

Auxiliary viewers should be placed at emergency control points, or wherever they are required for supervision. In a new plant, designer should allow for the TV viewer in the original control panel. ITV manufacturers make standard flush mountings. They build special receivers, too, if panel space is at a premium. But these increase the installation cost because they require extra engineering.

Duplicate viewers can be the same type as the original viewer. Or, in vidicon systems, they can be standard home-type receivers. These receivers require no modification. Just connect them to the control viewer with coaxial cable.

Camera and Receiver Installations Should Be Tailored for Each Job



HOUSING protects outdoor camera viewing power-plant stacks

RECEIVER shows boiler-water level to control-room operator

5 Limitations

Major limitations include lighting conditions, temperatures and inherent equipment characteristics that limit distance between camera and viewing screen (or monitor).

To produce a good picture, image-dissector camera requires high-level illumination—150 to 250 ft-c is best, 100 or less may be acceptable under special conditions. Vidicon camera needs 50 to 100 ft-c for good results.

Since camera must operate within limits of 0 to 150 F, special housings, mentioned above under 3, may be necessary.

Distance between control monitor and camera, in vidicon system, is held to maximum of 500 ft. But auxiliary viewers can extend the scene to 4000 ft, or further with amplifiers. With an image dissector, maximum separation between camera and viewer is 1500 ft. without booster amplification. There can be up to 100 ft between this camera and its separate power unit.

ITV compromises between several conflicting factors. High resolution, high sensitivity, broad spectral response and good contrast range of broadcast TV require complex, expensive equipment. How much can be sacrificed and yet produce an acceptable picture depends on the application.

For meter reading, checking furnaces, viewing smoke (normal uses in power plants today) any of the three systems can be used. In selecting a system for your plant, give careful thought to the needs of your application. How precisely defined must the picture be? Are there any auxiliary lighting problems? What distances are involved? Do you need auxiliary viewers or receivers? When you know what the needs are you can see which system does the best job for you.

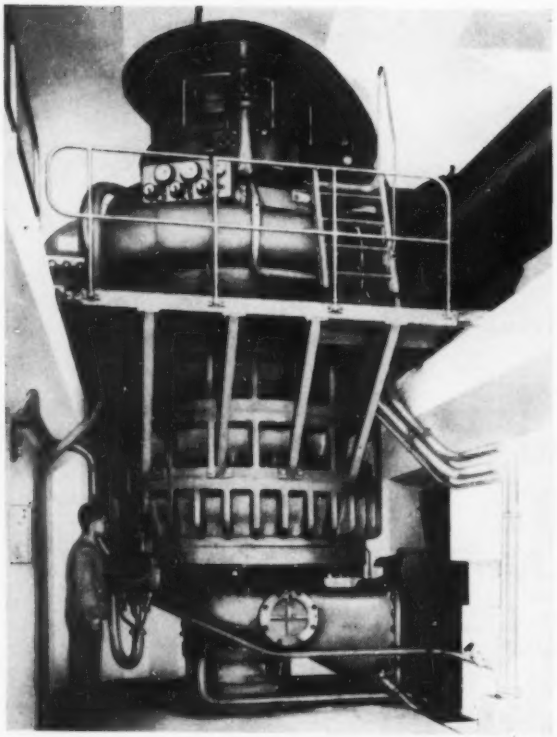
6 Maintenance

ITV maintenance depends on the type of installation and conditions surrounding the equipment. Where there is little vibration, no excessive heat or cold, no voltage fluctuation, the only maintenance ordinarily required is cleaning.

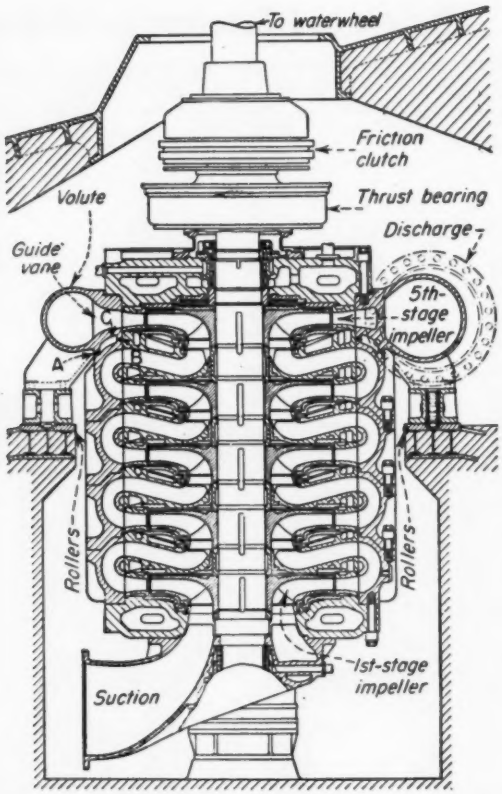
Ruggedness of equipment and total number of tubes play a large part in determining maintenance necessary. Simpler equipment generally requires less maintenance.

Chief maintenance required after initial adjustment is occasional cleaning. Based on equipment used up to the present, largely the image-dissector type, cost of maintenance is believed to be approximately comparable to upkeep costs of average control-panel instrument. Although plant instrument personnel can correct ordinary difficulties, manufacturers recommend regular preventive maintenance to avoid trouble before it starts. Where there is voltage fluctuation, they suggest voltage-regulating transformers to reduce maladjustments and need for servicing.

For the material on which this report is based, the editors of POWER *wish to thank these four companies: Diamond Power Specialty Corp, Radio Corp of America, Allen B DuMont Laboratories, Inc, Dage Electronics Corp.*



1 One of two vertical-shaft 5-stage pumps, rated 35,525 to 38,165 gpm at 1611- to 1561-ft head, needs 21,450 hp



2 Cross section through one of the 5-stage pumps shows its circumferentially-split casing and volute on the last stage

Pumped Storage Capacity Improves Big

Two pumps rated 35,000 gpm against 1611-ft head, installed as part of 120,000-hp high-head hydro plant, economically provide a wide range of power-system operating flexibility

► HYDROELECTRIC PROJECTS that have water-storage reservoirs offer several advantages when operated in parallel with other types of plants on large power systems. Pumping can often supply increased water storage economically when it is needed. A number of conditions, or combinations of them, may justify using off-peak or dump power to pump water into storage for daily or seasonal power generation. In Europe, the Etzel power development represents one of these projects using high heads and a combination of natural runoff and pumped storage for large power output.

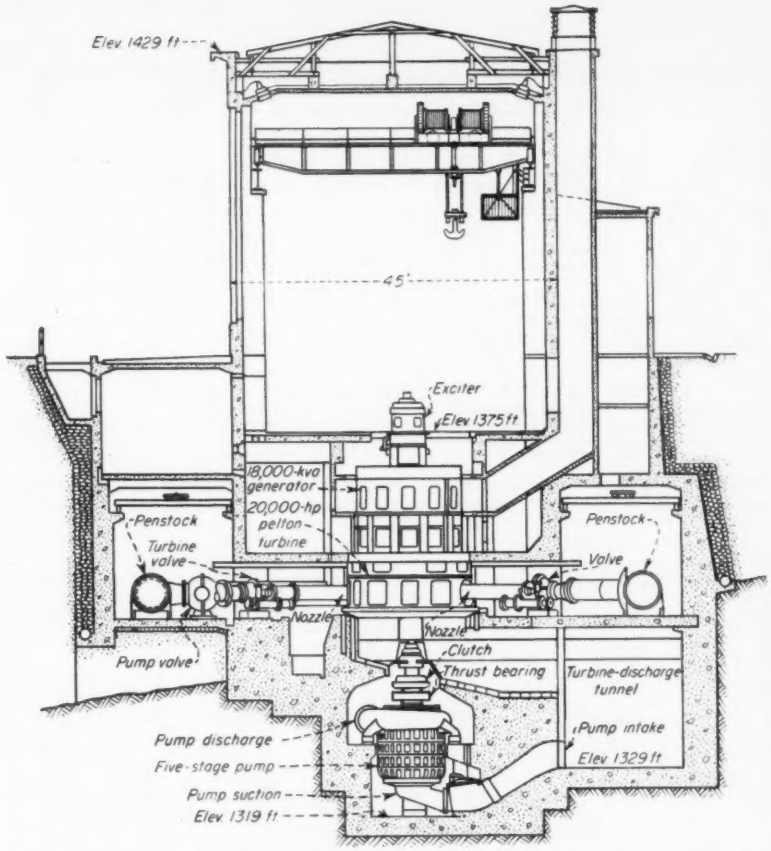
Etzel power project, in central Switzerland, near Altendorf, uses the difference in elevation between Lake of Zurich and artificial Lake Sihl, on a river of the same name. Lake Sihl, formed by three dams, has storage capacity of 3.4-billion cu ft (78,000 acre-ft). A tunnel nearly two miles long, designed for 1130 cfs maximum flow, runs through a mountain from Lake Sihl to a surge tank and valve chamber above Lake of Zurich.

Two penstocks extend down to the powerhouse near the lake into which a discharge tunnel empties, Fig. 4 and 5. This 1400-ft discharge is a tunnel 15 ft high by 16.5 ft wide for 1220 ft. Then it widens to 30 ft in an open channel. When the storage reservoir is filled to maximum elevation of 2929 ft, total head to Lake of Zurich is 1586 ft with the lake at mean elevation 1343 ft.

Power Units. Six vertical-shaft 2-nozble Pelton waterwheels are installed with a nozzle on opposite sides of each wheel. On the operating floor inside the powerhouse along its side walls runs one of the two penstocks, to which a nozzle from each waterwheel connects, Fig. 4. These wheels are each rated 18,000 to 22,000 hp under an effective head between 1381 and 1568 ft. This gives the present plant a capacity of 120,000 hp, which will be increased to 160,000 hp when two more units are installed.

Three of the wheels connect to 18,000-kva single-phase 10-kv 16 2/3-cycle generators, which supply power to the Swiss Federal Railways. The other three wheels connect to 3-phase generators of the same capacity and voltage, but are designed for 50 cycles. These three units supply power to Nordostschweizerische Kraftwerke A.G.

Material for this article was supplied by Sulzer Brothers, Ltd, Winterthur, Switzerland.



3 Cross section through powerhouse at one of the pumped storage units. Pump below the turbine can be moved out into the assembly space between the two units

Power System's Operation

Pumping Units. When the power project was designed in 1932-33, provisions were made for two 38,000-gpm pumps. But the Swiss Federal Railways and the power company were not sure the extra power that would be made available by the pumps could be used. So they were not installed, but space was provided for them below two turbines. These pumps were not ordered until 1945 when a severe power shortage justified their installation.

One pump connects to the turbine of a single-phase generator and one to that of a 3-phase machine, on either side of the powerhouse transverse center line. They had to be selected not to exceed the power capacity of the generators installed, when operated as motors, and were ordered for 38,165 gpm each at 1561-ft head and 500 rpm.

Fig. 2 shows a cross section through one of the two pumps. Their designers had to face the problem that the pumps' foundations had been built ten years earlier for 4-stage pumps. Design improvements and the need for highest efficiency favored 5-stage pumps. To install them in the space available required connecting the pumps to the waterwheels by specially designed friction-clutch couplings.

As the project worked out, Sulzer Brothers built the pumps including their shafts and Escher Wyss supplied the clutches for connecting the pumps to the waterwheels, the step bearings, the spherical seating valves and connecting piping.

Outside diameter of the 5-stage pumps is smaller than that of the 4-stage, and required minor changes in the foundations. For easy assembly and dismantling, the pumps are permanently mounted on rollers, so they can be pushed in or pulled out from under their power units onto the pump-room floor between the two machines, Fig. 4. The powerhouse crane can then handle their parts without any difficulty.

Few pumps of this size have been built for heads over 1600 ft. For this reason construction of their volutes and head covers required new designs for which previous experience was not available. The pumps are a diffuser type, have circumferential split casings with the last stage discharging into a volute.

Volutes, made without external ribs to insure sound castings, are welded to the fourth-stage section of the diffuser casing to avoid concentration of material and stresses. These joints are made with a double circumferential weld, at *A* and *B*, Fig. 2. After making the welds the space between them at *C* was used to hydraulic-pressure test the joints.

Thrust Bearings, Couplings. Because of design, total axial thrust and weight of the rotor, about 100 tons, had to be taken on a thrust bearing. This bearing is supported on the cover plate of the volute. Each pump could have been connected to its turbine by any one of several methods, but to meet space restrictions and have the coupling as simple as possible a specially designed friction clutch was selected.

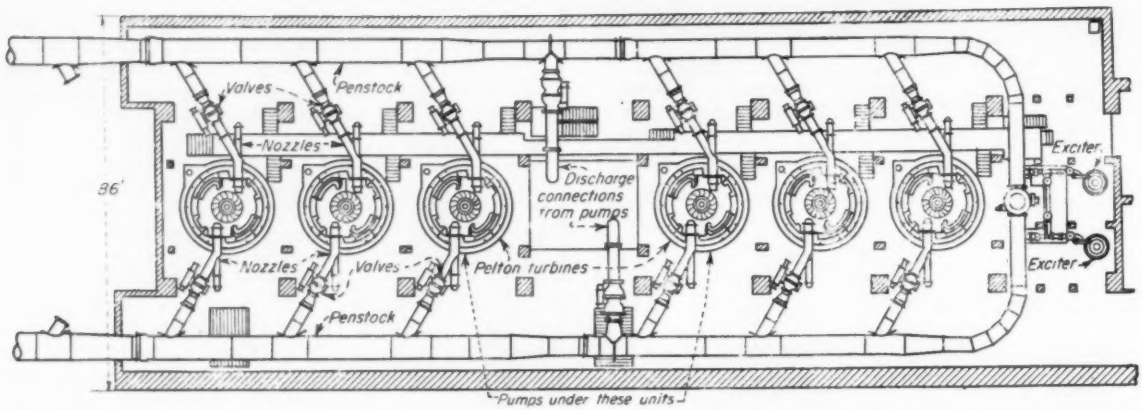
Installed in each pump's discharge pipe is a hydraulically operated spherical service and a manually operated isolating valve. The service valve closes automatically when pump speed drops to 300 rpm or when there is a serious pressure drop in discharge connection.

Power for Pumping. Surplus power in the system may not be enough for one pump motor, 20,500 hp. Any one of several methods might have been used to control the output, but it was decided to operate the pumps at full capacity when in service. Any deficiency in electric power for a pump generator-motor is supplied by operating its turbine. For example, if only 15,000 hp of surplus power is available for one pump, the remaining 5500 hp is supplied by using part of the pump's discharge to drive its turbine.

In this way the pump is operated at full capacity, but the pump discharges only part of its rated capacity to the reservoir, as if it were throttled. This system of regulating the pump's load has been satisfactory at an efficiency as high as would be obtained by throttling or by using wicket gates.

When power fails, stopping a large pump is a complex problem that requires careful study. Account must be taken of pump speed changes and pressure changes in the piping system. Unless controlled, speed drops quickly, pump's direction of rotation reverses within a few seconds, and the impeller running as a turbine reaches runaway speed of 1.25 times normal.

Reverse operation had to be avoided,



4 Turbine floor plan of the powerhouse. Pelton turbines have two nozzles, one connected to each of two penstocks along opposite sides of the powerhouse. Pump discharge connections come up between the two groups of vertical-shaft waterwheels

PUMPED STORAGE

continued

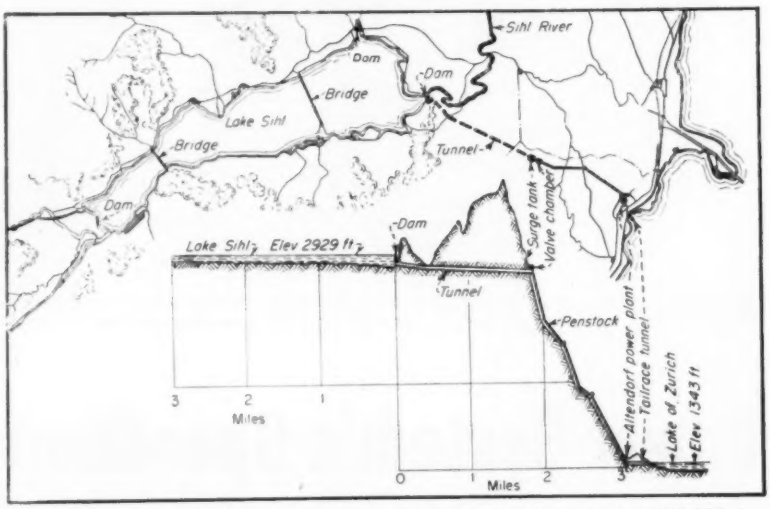
because of the pumps' thrust bearings. This could have been done by different valve schemes but, again, the turbines control shutting down the pumps. This is probably the first time this method has been used.

With this system, when electric power to a pump fails and it starts to slow down, the governor opens the turbine's nozzles. The turbine then brings the unit to speed ready to synchronize the generator for connection to the power system.

To adapt the turbine governors to this type of control they are supplemented by a safety governor driven by the exciter shaft. This governor has switches that trip the generator-motor off the power system if speed drops 5% below normal and that start closing the isolating valve in the discharge line if pump speed drops to 60% normal.

Pumping-Plant Benefits. Only during dry summers, when natural drainage fails to fill Lake Sihl are the pumps needed to help fill the lake. Normally they serve principally to balance the power supply over short periods, generally a few weeks each year. Nevertheless, the storage pumps have substantially improved performance of the power station.

Government regulations are quite rigid as to the date when Lake Sihl must be filled in summer. The pumps make it possible to meet these requirements always. If surplus night and weekend power is available from base-load stations, pumping during these periods may be valuable to improve load factor of the power system. This is true in spring, summer and autumn, and also in winter when water is lowest in the rivers supplying other plants on the power system.

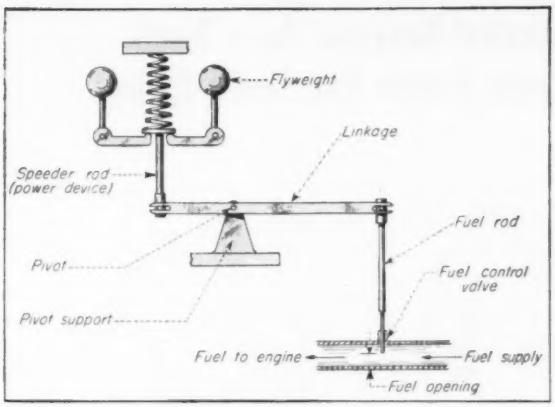


5 Plan and profile of the Etzel hydroelectric development. It has 120,000 hp installed capacity in six 20,000-hp units operating under a 1500-foot head

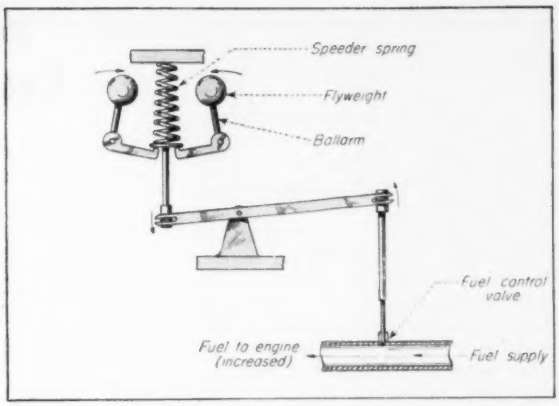
Low-Water Operation. Because of extremely low water during the winter of 1949-50, Switzerland was threatened with a power shortage. Every available means was needed to meet these conditions without seriously restricting power use, including importing power from systems outside the country.

Much of the imported power was available during nights and weekends only. For example, Holland furnished power from 10 pm to 6:30 am, and on Sundays. Part of this power was used in the Waggital and Etzel stations to drive pumps to store water for peak-load generation during week days. Water was also stored in the reservoir of the Oberhasli power station of the Bernische Kraftwerke for week days. During week-day nights part of the power generated in the Beznau steam plant pumped water into storage. In this way the Etzel pumped-storage plant and others like it have given excellent service, not only during power shortages but also in normal times, when the system can easily carry the off-peak and peak loads.

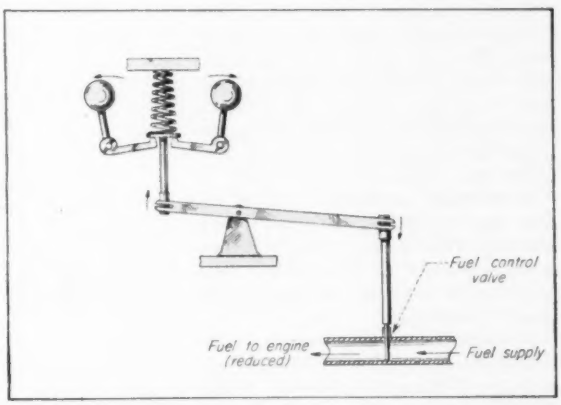
Conclusions. Hydroelectric pumped-storage plants have an advantage on most large power systems. They increase the output of many hydro plants and use power surpluses that might otherwise go to waste. The Etzel power station is an interesting example of a high-head plant where storage pumps improve performance and economy, in spite of natural runoff that fills its reservoir during normal years.



1 Schematic arrangement of the fuel-control mechanism for diesel and dual-fuel engines. Valve shown is simplified



2 The combined action of speed-measuring and fuel-changing mechanism during load increase in a mechanical governor



3 Action in a simple mechanical governor during decrease in engine load. Governor reduces fuel supply to engine

DIESEL GOVERNORS—II

What Does Speed Regulation Mean?

It's the job of your governor to keep engine speed within desired limits for load carried. This second article of our series shows you how mechanical governors are applied today

By EDGAR J KATES, *Consulting Engineer, New York*

► LAST MONTH we discussed the various types of governors available for diesels and other high-compression engines. We're now ready to take a closer look at what happens when a governor regulates engine speed.

Speed regulation is the change in an engine's "steady" speed (its final or sustained speed) when load is changed from the full-rated value to zero, or vice versa, without governor adjustment.

Change in steady speed is expressed as a percent of full-load speed by:

$$\text{Speed regulation, \%} = 100\ (\text{no-load rpm} - \text{full-load rpm}) \div \text{rated full-load rpm}$$

Note that speed regulation refers to a change in *steady* speed. This means that governor and engine are given enough time to reach a stable position and speed, respectively, for the given load. For partial changes in load, steady-speed change is proportional to the speed regulation.

Example. Suppose our engine runs at 600 rpm at full load, and at 624 rpm steady speed when all load is removed. Since speed increase is 24 rpm between full and no load, speed regulation is $(100)\ (24) \div 600 = 4\%$.

Knowing the speed regulation we can easily compute speed change for any partial load change. With a load change of one-quarter rated load, say from 4/4 to ¾, or ¾ to ½ load, resulting speed change is one quarter that from full to no load. For this engine it is ¼(24) = 6 rpm. Table below summarizes change of speed with load, for this engine.

Load	*Speed, rpm*	*Speed change, %*
Full (4/4)	600	0
¾	606	1
½	612	2
¼	618	3
0	624	4

Speed regulation is important for many reasons. One is that it determines how two or more engines driving the same load will share any load change. An engine's speed regulation is directly related to the governor speed droop.

Speed droop is the change in rotating

speed of governor that causes its output shaft (fuel-control rod) to move from full-open throttle position to full-closed position, or vice versa. Since every speed governor is a device responding to speed changes, its droop shows how big a speed change is needed to cause the governor's output shaft to travel through its full range.

Speed droop of a governor differs from engine speed regulation in that droop may be either *permanent* or *temporary*. Governors must have speed droop to prevent false motions or overcorrection. With permanent speed droop, governor's output shaft comes to rest in a different position for each speed. Consequently, the engine's final or steady speed is different for each load.

With a temporary speed droop, the governor's output shaft always comes to rest at the same speed. As a result, engine's final (steady) speed remains constant, regardless of load. Since this is often advantageous, many hydraulic governors are designed to use temporary rather than permanent speed droop.

Isochronous governors regulate engine speed so speed regulation is zero percent. This means engine's steady speed is exactly the same at any load from zero to full load. Governor speed droop is temporary.

Momentary speed changes, also termed instantaneous speed changes, are temporary changes occurring immediately after a sudden load change. These always exceed the final speed change corresponding to the speed droop. Momentary speed changes are expressed as percent increase or decrease in speed, referred to engine speed at the instant of load change.

Hunting is the rhythmic or repeated variations in speed due to over-control by the governor. It is of a continuous nature: the oscillations keep repeating themselves. These periodic speed variations may occur through no fault of the governor. If it is responsible, hunting ceases when engine throttle is blocked in a fixed position. Governor does not cause oscillations that continue after throttle is blocked.

Stability in a governor is its ability to maintain speed with either constant or varying loads without hunting.

Sensitivity is speed change needed before governor makes a corrective movement of the throttle. This speed delay results from the lag in governor action caused by friction and lost motion in governor mechanism. Narrow band of speed variation through which governor makes no corrective action is called the *dead band*.

Promptness is the speed of governor action, which depends on its power. The greater the power, the shorter the time required to overcome the resistances.

Work capacity denotes the governor's power as shown by the amount of work it can do at its output shaft. Work capacity, in in.-lb, equals average force, in pounds, exerted by governor at its terminal lever multiplied by distance, in inches, through which terminal lever moves in its full travel. Governor whose terminal lever exerts a 4-lb force over a distance of 3 in. has a work capacity of 12 in.-lb.

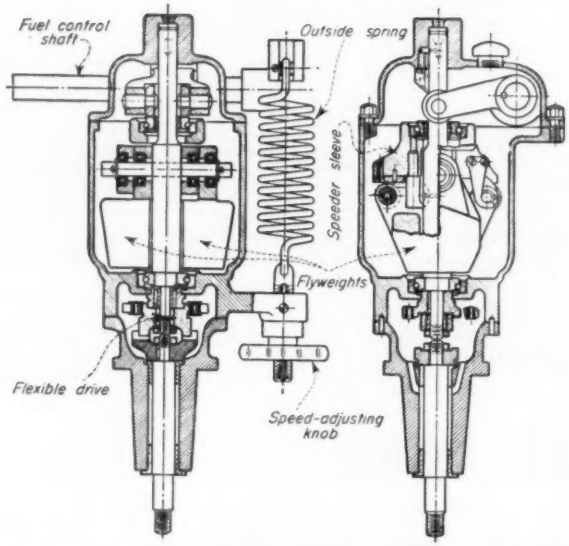
Corrective Action. Every governor depends on a change in speed for its *corrective action*, so-called because it corrects engine speed. Amount of speed change needed to produce corrective action determines amount of resulting throttle movement. The more *sensitive* a governor, the less the corrective action needed after a change of engine load. Also, rapidity of control movement, which depends on *promptness* of governor action, influences amount of corrective action needed when speed changes.

Both sensitivity and promptness are, therefore, important factors in performance. Some hydraulic governors combine sensitivity with high work capacity (promptness) to such a degree that they respond to a change in speed of less than 1/100 of 1%. They can shift fuel-control mechanism from full-load to no-load position, or vice versa, in less than one-quarter second.

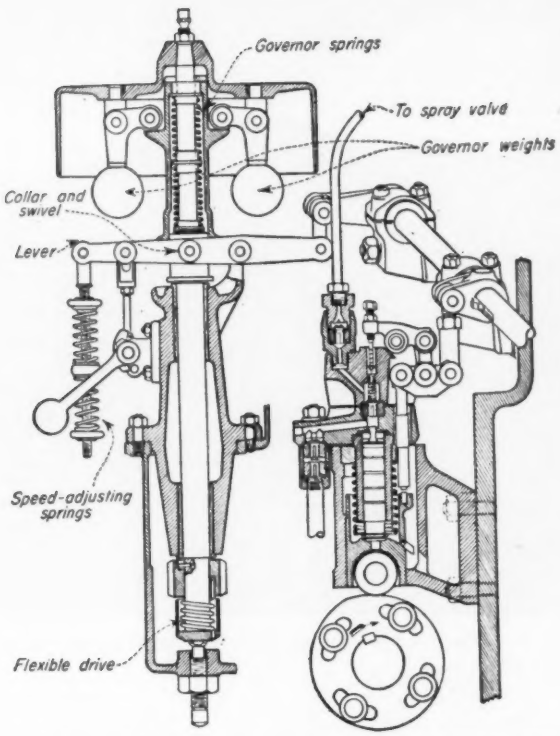
Engine speed deviation is any change in speed from normal. Deviation for a given load change depends on both engine and governor characteristics. Conditions determining it are, briefly (1) time needed to correct fuel-injection rate to correspond with new load (2) inertia of flywheel and other moving parts of engine and its connected load (3) time needed for engine's power output to respond to change in fuel-injection rate.

Item 3 depends on number of engine cylinders, engine speed, and type of fuel-injection system. For example, a 2-cyl 200-rpm engine takes longer to respond than an 8-cyl 1200-rpm unit.

Mechanical Governor for a Small High Speed Engine Has Single Spring



4 This mechanical governor is used on high-speed engines. The single outside spring performs a double function here



5 Mechanical governor and fuel pump for a diesel engine. Sleeve around the speeder spring acts like a speeder rod

Ideally, if it were possible to (1) detect instantly the amount of load change (2) correct the fuel-injection rate instantly and accurately, and (3) obtain immediate power response from the engine cylinders, then engine speed would never change no matter how rapid or great the load changes were. This is impossible, however, because of practical limitations. Actually, some delay always occurs between moment load changes and moment when engine responds to corrected fuel-injection rate. Flywheel inertia, by absorbing or supplying energy, reduces speed change during delay period, but the longer the delay, the greater will be the speed change. Therefore, precise speed control requires prompt, sensitive governors.

Mechanical Governors. Last month we saw that when governor ballhead speeds up, flyweight centrifugal force becomes greater than the opposing spring force. The opposite occurs when speed falls. Mechanical governors utilize these forces directly to operate the fuel-changing mechanism, Fig. 1.

This mechanism for diesel and dual-fuel engines consists of a power device (speeder rod) to transmit power directly from the flyweights, linkage to connect power device and fuel-control valve, and a fuel-control valve. Fig. 1 shows a simple gate valve instead of the elaborate design actually used in engines.

Now let's look at the combined action of the speed-measuring device and the fuel-changing mechanism in this elementary mechanical governor.

Load Increase. When load is applied to engine, its speed decreases, Fig. 2. Ballarm speed falls with engine speed, reducing centrifugal force of the flyweights, allowing speeder spring to force flyweights in and push speeder rod down. As speeder rod moves down, fuel valve opens to increase fuel flow. Greater fuel supply increases engine output to carry the larger load. Engine speed rises but does not reach the original speed. If it did, the throttle would not be open wide enough to supply the increased load. Wider throttle opening can be obtained only by the flyweights being *in* toward their axis of rotation by reason of slower speed.

Load Decrease. On dropping engine load, speed increases, Fig. 3. Higher ballarm speed increases centrifugal force acting against speeder spring to raise speeder rod. This closes fuel valve to reduce fuel supply, lowering engine output to meet decreased load. Engine speed falls, but not to former value because it is not possible, mechanically, to maintain reduced throttle with flyweights back in original position. The smaller fuel opening needed for reduced load requires that ballarms be *out* from the vertical by reason of higher speed than before.

Note that in this governor action the final (steady) speed of the engine is less after load is picked up and higher after load is dropped. This permanent speed droop is inherent in all mechanical governors because the power of the flyweights moves the throttle directly by mechanical means. For many services, a reasonable amount of permanent speed droop is quite satisfactory.

Advantages. Mechanical governors are inexpensive and simple, and are satisfactory where it isn't necessary to maintain exactly the same speed, regardless of engine load.

Disadvantages. Sensitivity is poor because speed-measuring device must also furnish the force to move engine fuel control. Unless governor is extremely large, its power is relatively small. Speed droop is unavoidable, and governor cannot provide truly constant speed where it is needed.

Designs. Fig. 5 shows a typical mechanical governor and fuel-pump assembly. Note that sleeve surrounding speeder spring acts in the same way as the speeder rod in previous diagrams. Speed adjuster uses an independent set of outside springs. Flexible drive at lower end of governor drive shaft prevents momentary engine speed fluctuations from disturbing governor action.

Fig. 4 shows a mechanical governor used on small high-speed engines. It employs a single outside spring, which acts both as speeder spring and speed-adjuster spring. Antifriction (ball) bearings improve the governor's sensitivity.

Fuel-injection pumps of small engines often include a built-in mechanical governor for compactness. Depending on the class of service, such governors are the speed-limiting, variable-speed or constant-speed types.

The next article in this series discusses hydraulic governors for modern diesels.

HUGE HOGGED-FUEL PILES standing next to industrial and thermal generating plants are common sight in our Northwest

To Burn Wood Efficiently Choose Properly Designed Combustion Chamber

Waste wood's value varies from a nuisance, to be gotten rid of as cheaply as possible, to a salable commodity in high demand. To make best use of heating values, wood-fed furnaces must be engineered as carefully as those burning other fuels

By **M F ANDERS**, *Mechanical Engineer, F E Balden Co*

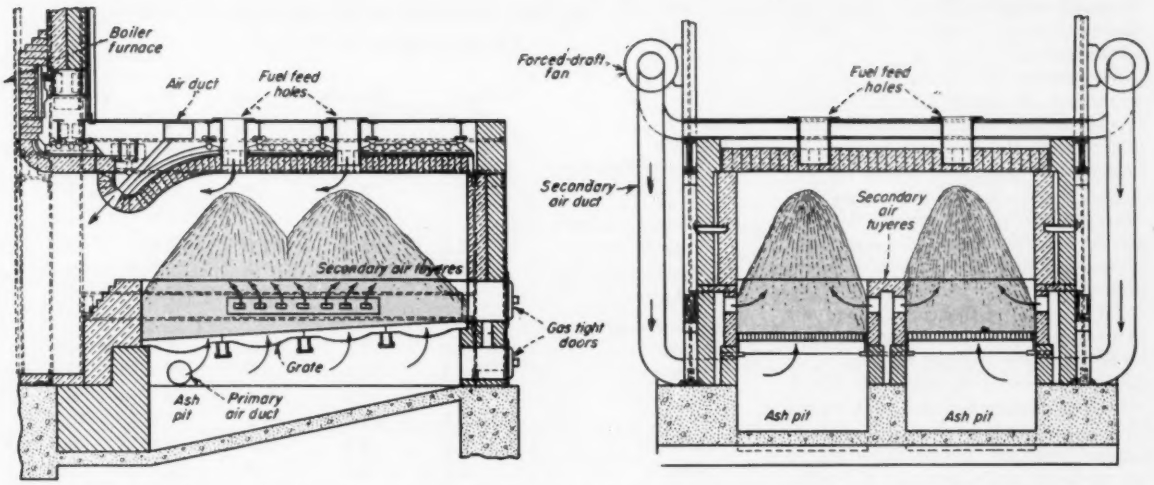
► LUMBER MILLS, remote from industrial and residential areas, generally find their waste wood an operating liability. They can't locate a market, so must expend effort and money to get rid of the waste. Generally they use conveyors and refuse burners to dispose of it. This requires not only investment in equipment, but also labor to run and maintain it.

Most mills, however, use steam to run engine drives, "shot guns" for log carriage propulsion, log kickers or hoisting cylinders, dry kilns, glue pots, plywood presses, and also electrical generating, distribution and application equipment. Lumber and paper mills use their wood wastes to fuel this apparatus. If the waste has a market value, it becomes especially important to burn it with maximum combustion efficiency, so a return can be realized from hogged-fuel sales.

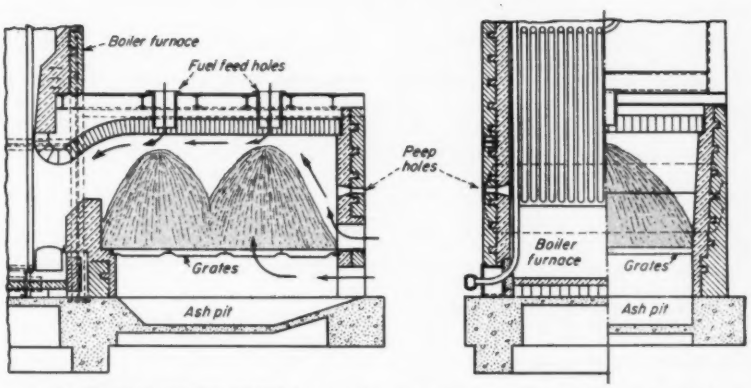
Dutch ovens are universally used for furnaces burning wood in steam boilers, see drawings p 91. They must be carefully designed to do a proper burning job. Dutch-oven layout controls the size of boiler, wood bin and auxiliaries. Usual combustion principles govern design of these dutch ovens taking into account, of course, the special characteristics of wood as a fuel, especially its high moisture content.

Measures. Wood waste is usually sold on a volume basis, *one unit* occupies 200 cu ft. One unit is assumed to weigh 4500 lb. Actual weight, however, depends on entrained moisture, kind of tree the waste comes from, consistency of the waste. This practice shows the "primitiveness" of waste-wood fuel industry and the need for classification.

Wood refuse may consist of sawdust, shavings, broken-up trimmings, slabs, bark, defective lumber pieces, sander dust, or any combination of these. All contain carbon, hydrogen and moisture,



PRODUCER-GAS DUTCH OVEN controls air supply to meet fluctuation in steam demand, uses forced draft for undergrate air and overfire excess air. About 85% of air flows in above grate to complete combustion. Air blast insures turbulence



CONVENTIONAL DUTCH-OVEN furnace has minimum control of air flow for combustion. Hogged fuel drops on grates from overhead bin through fuel feed holes in top

as do all fuels. Particle size varies from minute specks of sander dust to pieces as large as 2x2x6 in. coming from the wood "hog."

Characteristics. From a steam-raising standpoint the different woods may be graded as follows:

Western hemlock	poor
Western fir	good
Western pine	good
Western spruce	fair
California redwood	poor

Moisture content is the most variable component of wood-refuse fuels. For approximations in furnace design, the following constants may be used:

Heating value, dry	9000 Btu per lb
One unit weighs	4500 lb
Fixed carbon, as received	10%
Volatile matter, as received	40%
Ash, as received	0.5%
Moisture, as received	50%

Detailed analyses for specific woods are given in Table I. Principal characteristics of waste-wood fuels are high moisture content, high volatile content, high oxygen content, low ash.

Typical flue-gas analysis when burning Western fir shows CO_2 of 12.5%. While the wood ash is minute compared to most fuels, the constituents it contains are large in number. Here is a typical analysis of the ash by weight:

Silica, SiO_2	33.70%
Alumina, Al_2O_3	2.21%
Lime, CaO	24.30%
Magnesia, MgO	7.30%
Iron, Fe_2O_3	4.22%
Phosphorous, P_2O_5	5.44%
Titania, TiO_2	0.01%
Manganese, Mn_3O_4	0.54%
Copper oxide, CuO	0.87%
Sulfur trioxide, SO_3	2.90%
Soda, Na_2O	5.40%
Potash, K_2O	8.87%
Nitrogen, N	0.03%
Moisture	4.21%

Vaporization of moisture in the waste wood and gasification of volatile matter absorbs appreciable amounts of heat energy, Table II. These must be taken into account when designing a dutch oven. For high moisture contents around 65%, use of fuel dryers and air preheaters offers appreciable economies.

Waste wood stored for prolonged periods loses heating value from a form of low-temperature spontaneous combustion, called an isothermic reaction. If the storage pile is heated, the volatile matter progressively disappears by distillation, whether air is present or not to burn it.

In the furnace, the fixed carbon component of waste woods burns as fast as oxygen comes in contact with it. Fixed carbon on the fuel-pile surface burns to CO_2. Fixed carbon within the pile burns to CO. CO_2 generated at the pile surface reduces to CO if it comes in contact with hot carbon before cooling. As fixed carbon burns, the ash deposits and falls through the grate, or is carried up

the stack as flyash. Extraneous matter, like earth, stones, sand, forms clinkers on the grates.

Combustion air enters the furnace, up through the grates, through openings in the furnace doors to pass over the fire, through the feed-hole openings in uncontrolled form, horizontally through special tuyeres in side and center partition walls above the grates. Air may also be admitted through tuyeres in the bridge wall and through nozzles in the arch nose.

All oxygen passing up through the first two inches of burning fuel bed combines with the carbon to form CO_2. Above this level, CO_2 reduces to CO on contacting further hot carbon. Combustible gas leaving the fuel bed contains CO and hydrogen, a combination known as producer gas, which has a heating value of about 200 Btu per cu ft.

Increasing air-flow rate through the grate raises the gas-production rate without affecting completeness of combustion. Producer gas burns at the surface of the cone-shaped fuel pile. To complete this burning, about 85% of the combustion air must be supplied over the fire, the remainder through the grate.

Air for burning the gas must be applied near the fuel-pile surface with a velocity great enough to insure contact and turbulence. This insures maintaining a high temperature and causes a high rate of heat transfer to freshly fired fuel to force rapid distillation of moisture and volatile.

Theoretical combustion air

$$= 11.61C + 34.8(H - \frac{O}{8})$$

where C, H and O are weights of these components per lb fuel as shown by the ultimate analysis.

Actual air needed for combustion varies from the theoretical over a wide range depending on furnace layout, load, fuel type, firing method, as it does for any fuel. Excess air must be determined experimentally for each installation. In general, hogged fuel needs about 33% more air than No. 6 fuel oil. To recapitulate well-known relationships: (1) CO_2 in flue gas is an index of combustion efficiency. (2) Exit-gas temperature is an index of boiler efficiency. (3) Combustible in the ash is an index of grate efficiency. Within limits each of these indexes influences the other.

Burning Behavior. Small particles, like sander dust, ignite and burn instantaneously. Pieces the size of sawdust take a few seconds to burn completely. Large pieces up to 2x2x6 in. may take hours to burn up. With these large pieces, the surface loses volatile matter and moisture first, and time elapses before the inner fibers give up these components. This delay results from the low heat conductivity of wood. Loss of moisture and volatiles causes the outer wood layers to shrink and crack. This permits the inner layers to give up their gaseous components.

Waste wood burns slowly because of the high moisture content. It can be burned as fast as water and volatile matter distill off. This matter in turn depends on the rapidity of heat supply. Fresh fuel receives heat by radiation from the burning fuel, walls and arch, and by conduction through the wood and furnace gases. For rapid combustion, fuel should be finely shredded.

Combustion temperature depends a great deal on moisture content. Maximum temperatures obtainable with 20% excess air at 70 F range as follows:

33% moisture	3000 F
50% moisture	2580 F
60% moisture	2250 F
67% moisture	1950 F
71% moisture	1700 F
75% moisture	1450 F

Maximum temperatures obtainable with an air preheater, passing 85% of the combustion air entering the heater at 70 F and leaving at 600 F, with the remainder leaking into the furnace at 70 F, range as follows:

33% moisture	3720 F
50% moisture	2820 F
60% moisture	2480 F
67% moisture	2180 F
71% moisture	1900 F
75% moisture	1680 F

With moistures in excess of 60%, improved operation and efficiency war-

I: Typical Analyses of Waste-Wood Fuels Percentages by Weight

Fuel	*Calif. redwood*	*Western hemlock*	*Douglas fir*	*Pine sawdust*	*Average*
Moisture:					
As received, %	**50.4**	**57.9**	**35.9**	**—**	**48.1**
Air dried, %	**7.3**	**7.3**	**6.5**	**6.3**	**6.9**
Proximate analysis (dry):					
Volatile, %	**82.5**	**74.2**	**82.0**	**79.4**	**79.5**
Fixed carbon, %	**17.3**	**23.6**	**17.2**	**20.1**	**19.6**
Ash, %	**0.2**	**2.2**	**0.8**	**0.5**	**0.9**
Ultimate analysis (dry):					
H_2, %	**5.9**	**5.8**	**6.3**	**6.3**	**6.1**
C, %	**53.5**	**50.4**	**52.3**	**51.8**	**52.0**
N_2, %	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
O_2 %	**40.3**	**41.4**	**40.5**	**41.3**	**40.9**
S, %	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**
Ash, %	**0.2**	**2.2**	**0.8**	**0.5**	**0.9**
Higher heating value (dry):					
Btu per lb	**9920**	**8520**	**9050**	**9130**	**9180**

IV: Firing Data of West Coast Waste Wood

Heating value, dry	9000 Btu per lb	Feedwater temperature					180 F
Steam pressure	150 psig	Stack temperature					550 F
Fuel moisture, %	10	20	30	40	50	60	70
Heating value, as fired, Btu per lb	8100	7200	6300	5400	4500	3600	2700
Fuel moisture loss, Btu per lb	131	263	394	525	657	788	919
Volatile distillation loss, Btu per lb	144	128	112	96	80	64	48
Net heating value, Btu per lb	7825	6809	5794	4779	3763	2748	1733
Lb steam generated per lb fuel fired:							
At 40% over-all efficiency	3.00	2.60	2.22	1.83	1.44	1.05	0.66
At 50% over-all efficiency	3.70	3.25	2.75	2.28	1.80	1.31	0.84
At 60% over-all efficiency	4.50	3.90	3.33	2.74	2.16	1.57	0.99

II: Example Calculation of Available Heat in Wood Fuel

1. Heating value, 1 lb wood, dry basis		9000 Btu
2. Wood moisture, as delivered		50%
3. Heating value, 1 lb wood as delivered		4500 Btu
4. Heat loss to evaporate moisture from 32 F to 212 F steam = $0.5\left[(212-32)+970.4\right]$ =	575.2 Btu	
5 Heat loss to superheating steam from 212 to 550 F = $0.5(550-212)0.48$ =	81.1 Btu	
6. Heat loss to vaporize 79.55% volatile matter, dry basis = $0.5x0.7955x200$ =	79.6 Btu	
7. Total moisture and volatile loss		736 Btu
8. Net heating value, as delivered, (3)—(7)		3764 Btu

III: Typical Test Results, Boilers Burning Waste Wood in Producer-Gas-Type Units

Boiler A—Emergency fleet type, U.S. Coast Guard, cross drum, inclined straight tubes

Boiler B—Fourdrum watertube type

Boiler	*A*	*B*
1. Boiler heating surface, sq ft	2535	5000
2. Total steam heat output, Btu	$16.23x10^6$	$25.30x10^6$
3. Fuel net heat input, Btu	$29.05x10^6$	$37.71x10^6$
4. Efficiency, boiler, furnace, grate, %	55.9	67.0
5. Average steam pressure, psig	179	175
6. Average feedwater temperature, F	45	210
7. Average furnace draft, in. wg	—0.10	—0.11
8. Average draft at damper, in. wg	—0.50	—0.45
9. Average fuel moisture, as fired, %	45	56

rant installation of an air heater. The preheater raises combustion temperature about 240 F for the given conditions. Flue gas entering the heater must have a temperature at least 100 F higher than the leaving air to keep the heater within an economical size.

With a fuel containing 50% moisture a gas-temperature drop of 300 F causes an air-temperature rise of 520 F, because of the difference in specific heats of gas and air. This difference between rise and fall increases as the fuel moisture increases and as the amount of unheated air leaking through the feed openings increases.

Furnace Design. Two types of dutch-oven designs are the *conventional*, and the so-called *producer-gas type*, see p 91.

In the conventional type air for combustion enters through the grates below and the feed openings in the roof, in addition to coming through the furnace-door openings. None of this air is under control either by rate of flow, direction or intensity of blast.

Distillation air enters through the ashpit doors and comes up through the grates under the impetus of atmospheric pressure only. It finds its way through the fuel bed mostly where the pile is thinnest. This prevents uniform distribution of distillation air and minimizes the gas-generating capacity of the fuel pile. Air flow depends on the furnace draft, which in turn varies with fuel-bed thickness, size of fuel particles and relative "packing." This type installation has no positive-controlled gas generation.

Overfire air is drawn through small ports in the furnace doors, or through door frames if the doors are open. Doors are usually kept closed to prevent fires rolling out. This air is largely uncontrolled. At best it can only come in contact with front and sides of the fuel pile. A large part of this air rises and scrubs the arch and upper side walls, reducing the temperature of these surfaces.

Air leaking in through the feed-hole openings reduces air coming in through the furnace-door openings. It also cools the arch, aggravating the loss of radiated heat. Air and gas enter the boiler in uncontrolled fashion markedly reducing combustion efficiency.

The conventional-type dutch oven, comparable with the hand-fired coal grate, is an inefficient burner. It is a low-cost installation, but for given steam output requires a larger boiler and stack than does the producer-gas type.

Producer-gas-type ovens have distillation air forced into the ashpit under positive pressure by a blower, controlled by steam pressure. Much of the air finds its way through the thinner edges of the fuel bed, but the flow varies in response to steam demand. This feature reduces the grate and arch area needed. Distillation air is not affected by the air leaking in through the fuel-feed opening.

Overfire air enters under forced pressure through watercooled cast-iron tuyeres in side and center walls. This air blasts against the hot fuel pile where it contacts the hot carbon for good combustion. Practically the whole surface of the fuel pile has good oxygen supply.

In this type dutch oven there is a slight positive pressure. Hence the furnace and ashpit doors must be gas tight. The main combustion space below the boiler receives well-mixed gas and air from the dutch oven in controlled quantities.

Because of reduced operating and maintenance costs, watercooled grates are recommended for both type ovens. This feature practically eliminates clinker formation.

Center-wall oven partitions allow cleaning one side of the furnace at a time. For the producer-gas oven they provide space for installing more air tuyere castings. This breaks up the fuel bed into smaller units, exposing more fuel-pile surface to contact with oxygen. This more nearly approaches conditions in coal-fired furnaces with level fuel beds.

Cost Comparison. To give an idea how various fuels affect steam costs here are results of one study we made for a West Coast lumber mill:

Hogged fuel, 45% moisture, 4500 lb per unit, 9000 Btu per lb dry, $3.10 per unit delivered into dutch oven including a charge of 10c per unit for storage and conveying.

No. 6 fuel oil, 42-gal barrels, 150,090 Btu per gallon, $2.27 per barrel, includes 12c per barrel for storage, heating, pumping.

The resulting costs per 1000 lb of steam burning hogged fuel or oil were:

Wood in conventional oven	40c
Wood in producer-gas oven	26c
Oil in conventional furnace	52c

These figures do not include ash-disposal and soot-blowing equipment.

Table III shows some typical tests of industrial boilers burning waste wood. Table IV shows variation in boiler performance for different fuel and boiler conditions.

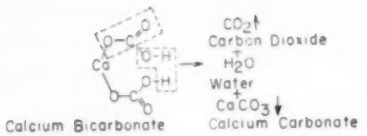
Most of this information was obtained from Frank Balden, president of F E Balden, Inc, Portland, Oregon. He has conducted research work in the field of waste-wood burning for many years. He also pioneered the producer-gas-type dutch oven. There are many of these plants on the West Coast.

Five Paths For Scale Build-up

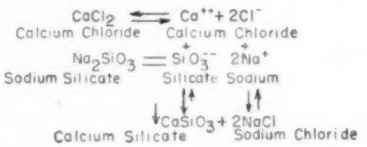
1. **Sedimentation of suspended solids happens only with unfiltered water**
2. **Crystallization is one path for soluble solids to settle out as scale**
3. **Supersaturation develops in the thick rings the steam bubbles leave behind**
4. **Starvation forces the highly soluble salts out as troublesome scale**
5. **Carryover comes from too wet a steam leaving drum; enters turbines, piping**

By **PAUL BRINDISI,**
Chemical Engineer, Celco Laboratories

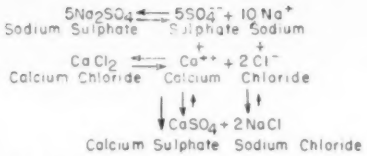
CHEMICAL REACTIONS THAT LEAD TO SCALE



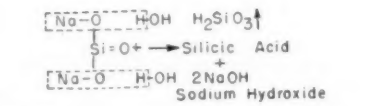
1 Calcium bicarbonate breaks up with heat; leaves behind calcium carbonate



2 Dissociation brings calcium and silicate ions together and out they go



3 Mass action is influence of solids, one on another, to bring on scaling



4 Carryover of soluble silicates hydrolizes upon cooling to form acid mist

Boiler Scale Wages 5-Pronged Attack

► ISOLATING ONE of boiler water's enemies—scale—as we did in January, p 84, is just getting off to a good start in controlling it. Next step is to understand how the scale forms. Today, we know there are five ways that scale gets its grip on boiler surfaces. They are: sedimentation, crystallization, supersaturation, starvation and carryover.

SEDIMENTATION

Scale that develops from settling out of suspended matter in water can only happen with an unfiltered raw water serving for makeup. All natural supplies carry suspended mineral particles —surface waters more so than underground. In some cases you can see the contamination with the naked eye. But, the more minute insoluble solids are barely discernible even under a strong microscope. Larger grains readily drop out if water stands any length of time. Minute ones exist in a semi-soluble state, termed colloidal. They'd take an extremely long time before they'd fall out of solution by themselves.

Muddy waters contain sand, clay or silt, which is wholly or mainly made up of silicates. The little hold cold water has on these grains disappears with the drop in water's viscosity that a little heat brings. Even with the exceptionally high blowdown rate required with such a contaminated water, solids build up in the boiler's lower sections, like the crown sheet or water legs of firetube boilers. Eventually sediment becomes packed, cemented, and then baked into a hard crust.

Slightly turbid and even apparently clear waters have silica and iron or alumina compounds in a colloidal state. As water steams and leaves a more and more concentrated water behind, these colloidally suspended particles come together to form larger, weightier pieces. Finally, they get big enough to fall out of solution.

But even so, the granules that come down from these thickened colloids, measure by comparison, much tinier than the average coarser grain of a loose suspension. So you'll find the scale the colloid mass lays down is more compact, adherent and insulating. What's more, it shows up throughout the water-submerged areas of the boiler, on tubes as well as shell. Blowdown, no matter how heavy, can't seem to touch it.

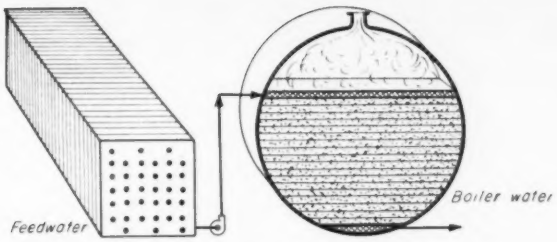
Scale from sedimentation occurs first, and usually causes boiler damage before scales develop. You'll find this most in firetube boilers operating at low pressures. Why? An unfiltered makeup water is out of the question for a watertube boiler. You'd have circulation problems from clogged-up tubes so fast you'd have to find the cause quick. The same thing holds for near-moderate pressures (100 psi and up) for either water or firetube designs. But the low-pressure firetube design can run on a considerable time before the problem's apparent; even then, it may be local.

CRYSTALLIZATION

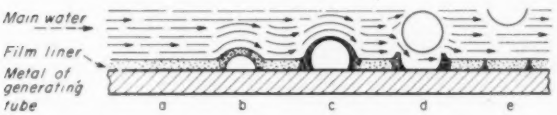
Soluble feedwater salts are brought down in a different way from the suspended ones we've just talked about. These soluble ones develop into scale problems as concentration builds up in the water. Just when they swing over to lay down scale depends on the boiler water's capacity for retaining each separate soluble salt it's carrying. This capacity is a function of prevailing temperature. As feedwater concentrates in a boiler, first one, then another of the soluble salts get beyond their saturation limits at the raised temperature and the excess drops out of solution.

The least soluble compound need not be the first to go because its original content may have been very low. Actually, the salt with a high initial strength is most likely to become the first to surpass saturation, followed by the next, and so on. Only compounds left in solution are those that remain within their solubility limits at the particular operating temperature.

The over-saturated salt surplus gathers into numerous, minute crystalline cones that build up to where their weight pulls them free of the boiling water. In growing numbers they blanket the metal surfaces and interlink. On fur-



5 Solids concentration left behind by steam is so heavy solids in new water cause scale unless you blow down



6 Supersaturation of solids in water film after steaming gets so thick it resists washing action of new water

To Cover Surface Areas

ther heating they fuse into a solid mass that becomes a dense, hard, adherent scale.

The exact way soluble solids crystallize out can be any one of four chemical reactions, all of which go on simultaneously in a boiler. They are decomposition, dissociation, concentration and mass action. Scales by these methods may occur in all sections of a boiler other than where steam is being generated.

Decomposition, Fig. 1, occurs with calcium bicarbonate. Of itself, this compound is quite soluble. But before it can concentrate to any appreciable extent the operating conditions decompose it, Fig. 1. Carbon dioxide boils off and leaves calcium carbonate behind. This compound has so low a solubility limit that its saturation level is quickly reached and the calcium carbonate begins to precipitate out.

Magnesium and sodium bicarbonate undergo a similar breakdown. But there the similarity ends. Magnesium carbonate is just as unstable. It goes on to precipitate a gelatinous hydroxide that is not scale-forming. Sodium carbonate, on the other hand, tends to stay in solution because it enjoys a high solubility.

Dissociation, Fig. 2, is what causes calcium and magnesium silicates to be removed from within the boiler-water entering stage. For example, in the dilution of feedwater moderate amounts of silica and calcium chloride prove compatible, and no reaction occurs. But under the influence of boiler water's concentrating natural alkalinity things start happening. The slightly dissolved and colloidal silica converts to sodium silicate, a highly soluble compound.

Then this salt follows the normal behavior of all salts in water. It tends to dissociate into its respective positive and negative components. Some salts do this more than others. A considerable portion of sodium silicate separates into sodium and silicate ions. Any calcium chloride present is going through the same experience and dissociating into calcium and chloride ions.

A free exchange takes place between the ions of these two salts. When calcium attracts silicates some calcium silicate forms and this virtually insoluble compound precipitates. Both the calcium and silicate ions tend to maintain the calcium silicate in equilibrium with themselves. But with the calcium silicate dropping out of solution as fast as it forms, the reaction swings heavily this way. Soon all the available calcium has been removed.

Concentration, a third way for dissolved boiler-water salts to crystallize, shows up with calcium sulfate, a moderately soluble salt. In Fig. 5, we assume a feedwater with a 32-ppm concentration of calcium sulfate going into a boiler operating at 300 psi. Corresponding saturation temperature is 422 F—a point where calcium sulfate's solubility limit is 640 ppm, 20 times what we start out with in feedwater. This means we can expose our feedwater to 20 cycles of concentration. Or we can evaporate 20 gal of feedwater down to not less than one gallon without exceeding the calcium sulfate solubility. But beyond this, the excess drops out of solution.

To continue making steam we have to bring in fresh feedwater as replacement. But incoming water brings with it 32 ppm of dissolved calcium sulfate that drops right out of solution and creates a scaling problem. If, however, we pull out one gallon of boiler water, we can add 20 gal of fresh water before we are up against this same problem. This removal of boiler water is called blowdown. And in our case it needs to be only 1/20th of the boiler feed, or 5%. If we raised the temperature above 422 F, we'd have to boost the blowdown rate even more because calcium sulfate, like calcium carbonate, acts contrary to the general rule of increased solubility with temperature rise.

But over and above the characteristic behavior of the individual compounds is the influence they exert upon one another, by way of mass action, Fig. 3. For instance, calcium chloride, by itself, is highly soluble. But in the presence of the usual boiler-water sodium salts in high concentrations the less soluble forms of calcium are forced out, and soon sodium sulfate or carbonate predominates.

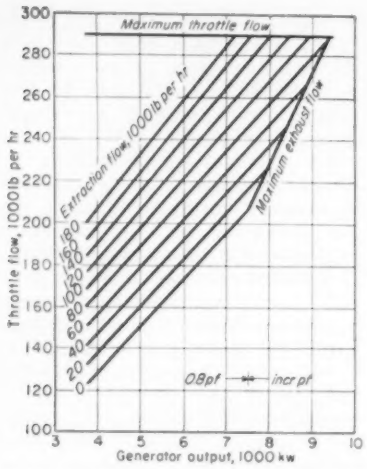
Take sodium sulfate as an example. We'll assume it develops to five times the calcium chloride content. In boiler water, both compounds undergo dissociation, Fig. 2, with sulfate ions greatly outnumbering the calcium ions. By mass action, calcium sulfate forms readily, and as quickly surpasses its saturation limit so the surplus precipitates. With such an overbalance of sulfate ions and the limited solubility of calcium sulfate, most of the calcium is driven out of solution.

With sodium carbonate in abundance this procedure goes on much more rapidly; calcium deposits out to virtual completion because of the relative insolubility of calcium carbonate.

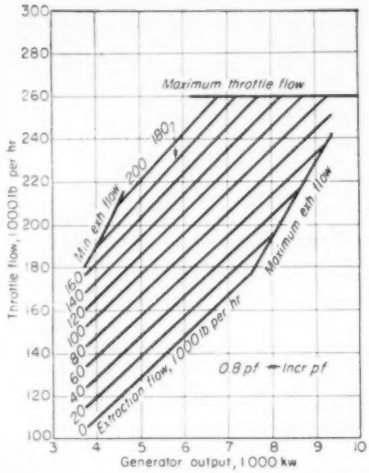
SCALE TYPES

Calcium and magnesium silicates form a glass-like deposit that often escapes early detection. They are most defiant to removal by either chemical or mechanical means. Calcium-sulfate precipitate is quite dense and extremely tough, whereas calcium carbonate,

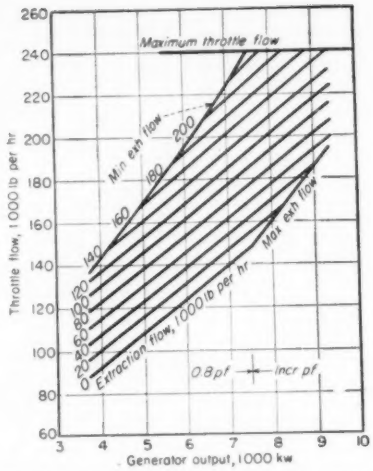
(*Continued on page* 192)



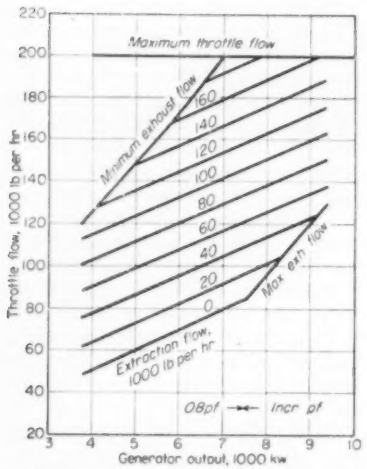
1 Noncondensing extraction turbine, 400 psig, 600 F, 50 psig, 150-psig bleed



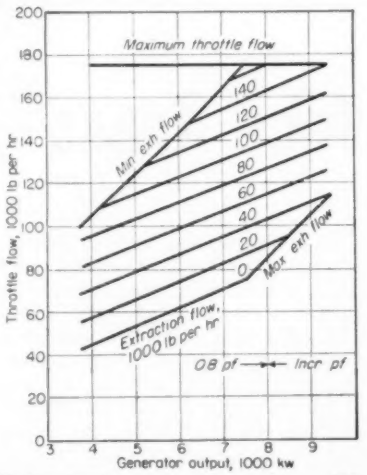
2 Noncondensing extraction turbine, 400 psig, 750 F, 50 psig, 150-psig bleed



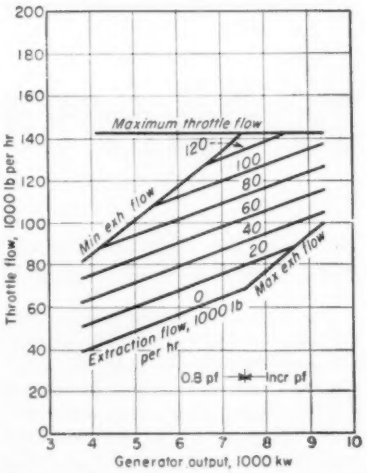
3 Noncondensing extraction turbine, 600 psig, 825 F, 50 psig, 150-psig bleed



7 Condensing extraction turbine, 400 psig, 600 F, 2 in. Hg, 50-psig bleed



8 Condensing extraction turbine, 400 psig, 750 F, 2 in. Hg, 50-psig bleed



9 Condensing extraction turbine, 600 psig, 825 F, 2 in. Hg, 50-psig bleed

How to Compare Automatic-Extraction

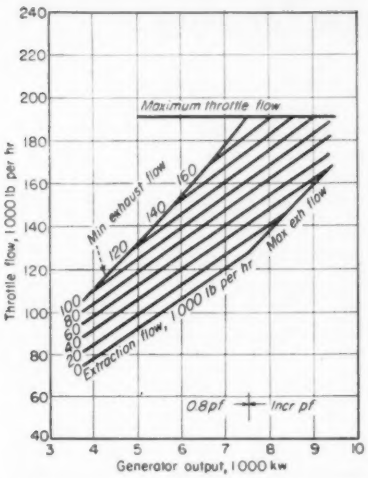
Here are details of proper method to pick best turbine to serve dual power and process-heating demands in your plant

By E V POLLARD, *Section Engineer*
Turbine Engineering Division
General Electric Co

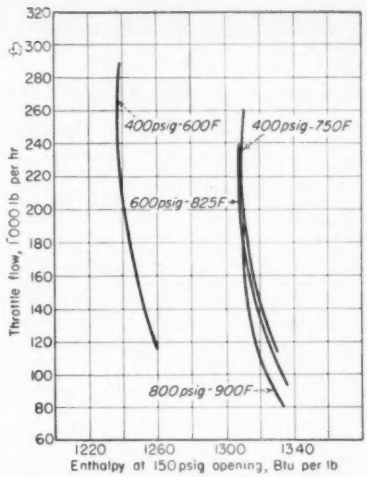
► COMPARING fuel consumption of automatic-extraction steam turbines at different initial steam conditions can be misleading if you use only a steamflow basis. We will develop here a step-by-step procedure for comparing fuel consumption on a constant heat-to-process basis. It's the logical way to compare alternate steam conditions since the process needs so many Btu per hr. Steam is only a medium for transporting heat, and the quantity needed for a process depends on the steam enthalpy, as well as the process heat needs.

We will cover a particular case of a noncondensing extraction turbine and a condensing extraction turbine, to simultaneously supply power and heat to a plant. Assume that total heat demand at each opening equals the sum of process and feedwater-heating requirements.

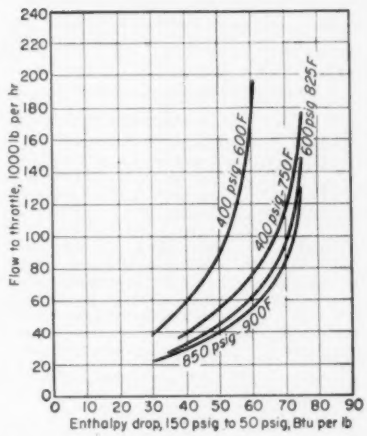
Table II, p 99, outlines specifications of a new boiler and turbine installation to supply power and heat. In an actual case, a number of loads and corresponding heats to process and operating hours would be studied. These additional points would also be calculated as



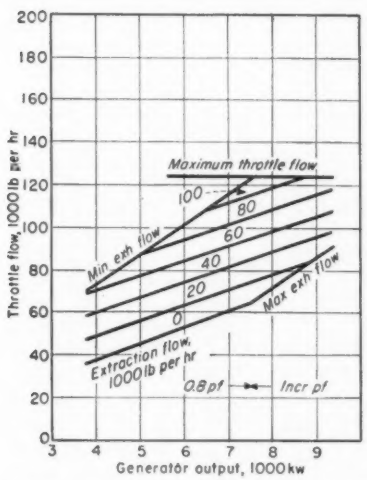
4 Noncondensing extraction turbine, 850 psig, 900 F, 50 psig, 150-psig bleed



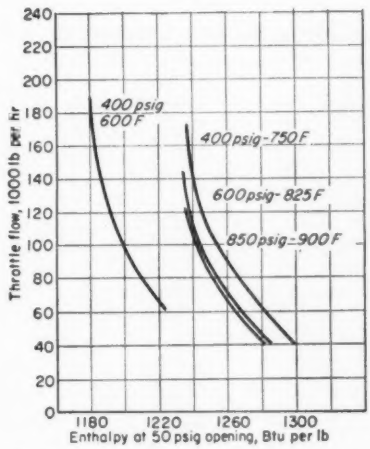
5 Noncondensing extraction turbines, relation between throttle flow, bleed h


Flow to throttle, 1000 lb per hr
400 psig-600F
400 psig-750F
600psig 825F
850 psig-900F
Enthalpy drop, 150 psig to 50 psig, Btu per lb

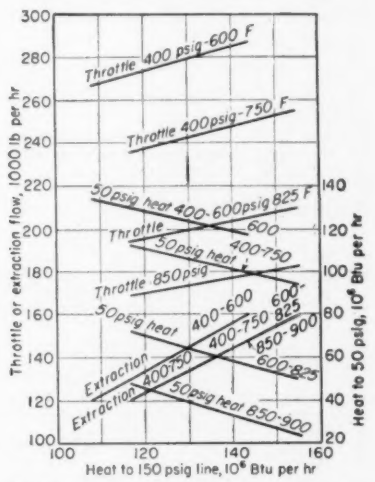
6 Noncondensing extraction turbines, relation of enthalpy drop to total flow



10 Condensing extraction turbine, 850 psig, 900 F, 2 in. Hg, 50-psig bleed



11 Condensing extraction turbines, relation of bleed enthalpy to flow


Throttle or extraction flow, 1000 lb per hr
Throttle 400 psig-600 F
Throttle 400psig-750 F
50psig heat 400-600psig 825 F
Throttle 600
50psig heat
400-750
Throttle 850psig
50psig heat 400-600 600-750 825 850-900
Extraction 400-750
Extraction 600-825
50psig heat 850-900
Heat to 50 psig, 10⁶ Btu per hr
Heat to 150 psig line, 10⁶ Btu per hr

12 Noncondensing turbines, relations between steam flows and heat flows

Steam-Turbine Projects

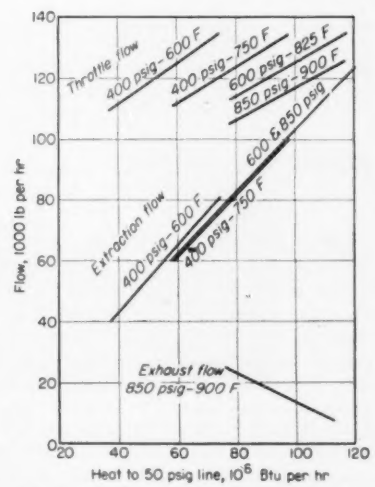
shown in Table I, see the top of p 98.

Maximum byproduct power with minimum flow to condenser is the primary objective of these industrial applications. Evaluation of different steam conditions indicates the most economical initial pressure and temperature. In such evaluations, consider future process requirements also.

In Table I, the 400-psig 600-F conditions are the present operating levels. For comparison, we have selected initial conditions of 400 psig, 750 F; 600 psig, 825 F; 850 psig, 900 F as modern levels for this method of turbine application.

Obtain from the turbine manufacturer noncondensing-extraction - turbine performance curves, Fig. 1, 2, 3 and 4, and the corresponding enthalpy curves, Fig. 5 and 6; also condensing extraction turbine performance curves, Fig. 7, 8, 9 and 10, and corresponding enthalpy curve, Fig. 11.

First part of Table I, *Derivation of extraction and throttle flows,* uses data from these figures to work up performance data for each steam condition at a particular load. These data are inter-



13 Condensing turbines, relations between steam flows and 50-psig heat

Table I: Step-By-Step Calculation of Extraction Turbine Comparison

DERIVATION OF EXTRACTION FLOWS AND THROTTLE FLOWS

			400 psig – 750F		600 psig – 825F		850 psig – 900F		400 psig – 600F	
1		Initial pressure and temperature								
		NONCONDENSING EXTRACTION TURBINE								
2	Select	Output, kw	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500
3	At (2) & (4)	Throttle flow, lb per hr	235,200	255,700	193,600	210,000	168,300	182,500	266,550	287,700
4		Extraction flow, for process and feedwater heating, lb per hr	120,000	160,000	120,000	160,000	120,000	160,000	120,000	160,000
5	(3)–(4)	Exhaust flow, for process and feedwater heating, lb per hr	115,200	95,700	73,600	50,000	48,300	22,500	146,550	127,700
6	Fig. 5⊙(3)	Enthalpy of steam at extraction opening, Btu per lb	1308.6	1309.3	1308.6	1307.6	1310.1	1310.0	1237.2	1238.2
7		Enthalpy of liquid at extraction pressure, Btu per lb	338.3	338.3	338.3	338.3	338.3	338.3	338.3	338.3
8	(6)–(7)	Heat to process and feedwater above (7), Btu per lb	970.3	971.0	970.3	969.3	971.8	971.7	898.9	899.9
9	(4)x(8)	Heat to process and feedwater above (7), Btu per hr	116.4×10^6	155.5×10^6	116.4×10^6	155.1×10^6	116.7×10^6	155.9×10^6	107.9×10^6	144×10^6
10	Fig. 6⊙(5)	Enthalpy drop from extraction opening to exhaust, Btu per lb	69.9	66.1	64.5	53.5	56.5	31.2	58.1	56.2
11	(6)–(10)	Enthalpy of steam at exhaust opening, Btu per lb	1238.7	1243.2	1244.1	1254.1	1253.6	1278.8	1179.1	1182.0
12		Enthalpy of liquid at exhaust pressure, Btu per lb	267.3	267.3	267.3	267.3	267.3	267.3	267.3	267.3
13	(11)–(12)	Heat to process and feedwater above (12), Btu per lb	971.4	975.9	976.8	986.8	986.3	1011.5	911.8	914.7
14	(5)x(13)	Heat to process and feedwater above (12), Btu per hr	111.9×10^6	93.4×10^6	71.9×10^6	49.3×10^6	47.65×10^6	22.75×10^6	133.6×10^6	116.8×10^6
		CONDENSING EXTRACTION TURBINE								
15	(A)–(2)	Output, kw	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500
16	At (15) & (17	Throttle flow, lb per hr	110,700	134,600	112,400	134,300	104,950	115,150	109,320	134,240
17		Extraction flow, lb per hr	60,000	100,000	80,000	120,000	80,000	100,000	40,000	80,000
18	(16)–(12)	Condenser flow, lb per hr	50,700	34,600	32,400	14,300	24,950	15,150	69,320	54,240
19	Fig. 11⊙(16)	Enthalpy of steam at extraction opening, Btu per lb	1248.2	1241.4	1239.3	1235.2	1239.7	1237.0	1195.4	1187.7
20	(12)	Enthalpy of liquid at extraction pressure, Btu per lb	267.3	267.3	267.3	267.3	267.3	267.3	267.3	267.3
21	(19)–(20)	Heat to process and feedwater above (12), Btu per lb	980.9	974.1	972.0	967.9	972.4	969.7	928.1	920.4
22	(17)x(21)	Heat to process and feedwater above (12), Btu per hr	58.85×10^6	97.41×10^6	77.8×10^6	116.1×10^6	77.8×10^6	96.97×10^6	37.1×10^6	73.7×10^6

CALCULATION OF ANNUAL FUEL COST AND FUEL SAVING

		NONCONDENSING EXTRACTION TURBINE				
23	(2)	Output, kw	7,500	7,500	7,500	7,500
24	(B,1)	Heat to 150 psig extraction line above (7), Btu per hr	128.6×10^6	128.6×10^6	128.6×10^6	128.6×10^6
25	Fig. 12⊙(24)	Heat to 50 psig exhaust line above (12), Btu per hr	106.2×10^6	64.9×10^6	39.9×10^6	124.0×10^6
26	Fig. 12⊙(24)	Throttle flow, lb per hr	241,600	198,800	172,700	278,500
27	Fig. 12⊙(24)	Extraction flow, lb per hr	132,500	132,400	132,300	143,200
28	(26)–(27)	Exhaust flow, lb per hr	109,100	66,400	40,400	135,300
		CONDENSING EXTRACTION TURBINE				
29	(15)	Output, kw	7,500	7,500	7,500	7,500
30	(B,2)–(25)	Heat to 50 psig extraction line above (12), Btu per hr	76.2×10^6	117.5×10^6	142.5×10^6	58.4×10^6
31		Heat to 50 psig line from turbine, Btu per hr	76.2×10^6	117.5×10^6	112.2×10^6	58.4×10^6
32		Heat to 50 psig line from reducing valve, Btu per hr	0	0	30.3×10^6	0
33		Throttle flow, lb per hr	121,300	135,000	123,500	123,800
34		Extraction flow, lb per hr	77,900	121,300	115,900	63,000
35	(33)–(34)	Condenser Flow, lb per hr	43,400	13,700	7,600	60,800
36		Steam passing through reducing valve, lb per hr	0	0	26,100	0
37	At (1)	Initial enthalpy, Btu per lb	1388.9	1420.9	1453.1	1305.8
38	(7)–10	Enthalpy of feedwater to boiler, Btu per lb	328.3	328.3	328.3	328.3
39	(37)–(38)	Heat added in boiler, Btu per lb	1060.6	1092.6	1124.8	977.5
40	(26)+(33)+(36)	Total steam flow from boiler, lb per hr	362,900	333,800	322,300	402,300
41	(39)x(40)	Total heat added in boiler, Btu per hr	384.9×10^6	364.7×10^6	362.5×10^6	393.2×10^6
42	Assume	Boiler efficiency, fraction	.85	.85	.85	.85
43	Assume	Auxiliary efficiency fraction	.96	.955	.95	.96
44	$\frac{(41)}{(42)(43)}$	Fuel supplied to boiler, Btu per hr	471.7×10^6	449.3×10^6	448.9×10^6	481.9×10^6
45	Assume	Hours of operation per year	7,500	7,500	7,500	7,500
46	Assume	Cost of oil, dollars per bbl	2.10	2.10	2.10	2.10
47	Assume	Heat content of oil, Btu per gal	144,000	144,000	144,000	144,000
48	$\frac{(44)(45)(46)}{(47)x42}$	Annual fuel cost, dollars	1,228,400	1,170,100	1,169,000	1,254,900
49		Annual fuel saving, dollars	26,500	84,800	85,900	0

EXTRACTION TURBINES *continued*

polated for use in the second section of this table.

The noncondensing steam turbine is the only heat source to the 150-psig line. With the 7500-kw load under consideration, an inspection of the flow curves in Fig. 1 to 4 indicates the approximate extraction flow needed to supply the 150-psig heat demand. In other words, at 7500 kw the extraction flow should be somewhere between 120,000 and 160,000 lb per hr. With these flows, data are worked out on lines 4 to 14. These data are plotted on Fig. 12 with the heat to 150-psig line as the abscissa because this is supplied only by the noncondensing steam turbine.

At the 150-psig heat requirement from Table II, heat supplied to the 50-psig line at each initial steam condition is indicated. Subtract this heat from the total required as given in Table II, line B-2; the condensing turbine must supply the remainder. Extraction flow corresponding to this heat is estimated, and bracketing extraction flows can be selected for use with Fig. 7 to 10 in calculating lines 16, 17 and 18. This table indicates the remaining operations to line 22. Data from these calculations are plotted on Fig. 13 against heat to 50-psig line.

We are now ready to make the calculations for *Annual fuel cost*. As before, consider the noncondensing extraction turbine first. At 7500-kw load enter Fig. 12 at the total heat required at 150-psig line, and read items for lines 25 to 27. Line 25 is the quantity of heat con-

Table II: General Data and Process Requirements

A. Total load 15,000 kw

B. Process and feedwater heating requirements:
   1. High-pressure line: 150,000 lb per hr of 150-psig saturated steam, usable heat = 128.6x10^6 Btu per hr
   2. Low-pressure line: 200,000 lb per hr of 50-psig saturated steam, usable heat = 1824x10^6 Btu per hr

C. Noncondensing 7500-kw turbine with automatic extraction at 150 psig and exhaust at 50 psig

D. Condensing 7500-kw turbine with automatic extraction at 50 psig and exhaust at 2 in. Hg abs

E. Alternate steam conditions selected at top of selling-price brackets

tributed to the 50-psig line by the exhaust of the noncondensing turbine.

Remainder of heat needed by the 50-psig process line must come from either the condensing extraction turbine or through a pressure-reducing desuperheating station. For the 400- and 600-psig turbines, this heat is supplied by extraction from these units. A quick check on this would be to proceed down to line 35; if this equals or exceeds minimum flow to condenser, the turbines are supplying this steam. For the 850-psig turbine, you find the flow to exhaust is negative when extracting the full balance to the 50-psig line.

Data for lines 33, 34 and 35 are obtained as follows:

For 400 psig, 600 F; 400 psig, 750 F; 600 psig, 825 F: Enter Fig. 13 at the heat to 50-psig line from the turbine (line 31), and read throttle flow (line 33) and extraction flow (line 34). Condenser flow (line 35) is the difference between these quantities.

For 850 psig, 900 F: Enter Fig. 13 at the minimum flow to exhaust on the condenser flow line for these steam conditions. Read the corresponding heat to 50-psig line, throttle flow and extraction flow.

Now find the heat to 50-psig process line from the reducing station (line 32), and calculate the required steam flow, as follows:

$$X\left[1+\frac{h_o-h_f}{h_f-q_o}\right]\quad (h_f-q_f)=\triangle Q$$

For given steam conditions and desuperheater spray-water temperature, this reduces to:

$X = \triangle Q/\text{constant}$

$\triangle Q$ = heat in desuperheated steam above (12), Btu per hr

X = steam flow to reducing valve, lb per hr

h_o = initial enthalpy of steam, Btu per lb

h_f = final enthalpy of desuperheated steam, Btu per lb

q_f = enthalpy of liquid at 50 psig, Btu per lb

q_o = enthalpy of spray water, Btu per lb

Assuming desuperheated steam to be saturated at 50-psig and 200-F spray water:

$X = \triangle Q/1159 = 30.3\text{x}10^6/1159$
$= 26{,}100$ lb per hr

Heat to process at each line has been assumed to include steam for feedwater heating. Therefore, the final enthalpy of feedwater has been taken as 10 Btu less than the enthalpy of saturated liquid at 150 psig on the assumption that a closed feedwater heater will be used at this point.

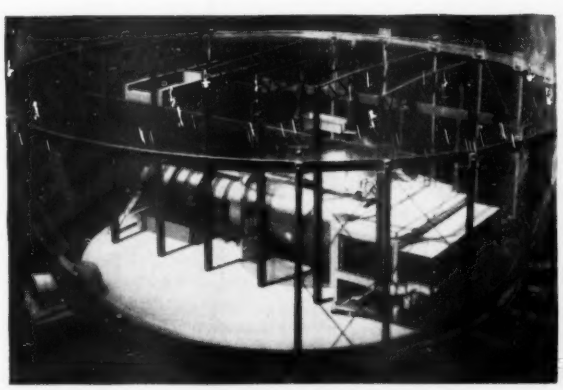
Reasonable values of boiler efficiency have been assumed. A variation of auxiliary efficiency has been made to approximate the change in auxiliary losses due to change in boiler-feed-pump power with boiler pressure.

Operating hours per year, fuel cost, and fuel heat content have been taken from an actual problem. These items would change for any specific application. If other loads and operating hours are to be included in a study, the complete group of steps, starting at line 1, should be repeated. In the end, annual fuel cost at each load should be summed up for the total annual fuel cost.

Line 27 of Table I, extraction flow, under the 400-psig 600-F and 400-psig 750-F conditions shows the different extraction flows, 143,200 and 132,500 lb per hr, required to supply the same heat to 150-psig process because of difference in enthalpy at the extraction opening. If evaluations are made on a constant-steam-flow-to-process basis without regard to enthalpy, the condition with the higher enthalpy is penalized. This method properly credits each alternative with its enthalpy at extraction point.

Line 49, annual fuel saving relative to the 400-psig 600-F application indicates only a small gain between 600 psig and 850 psig at the conditions of this study. The 850-psig initial pressure would not appear to be economical. Investigation at other loads and process needs, however, may show the higher pressure and temperature as worthwhile. Condenser flow, line 35, is a criterion on the minimum fuel cost, provided there is no steam passed through the reducing valve.

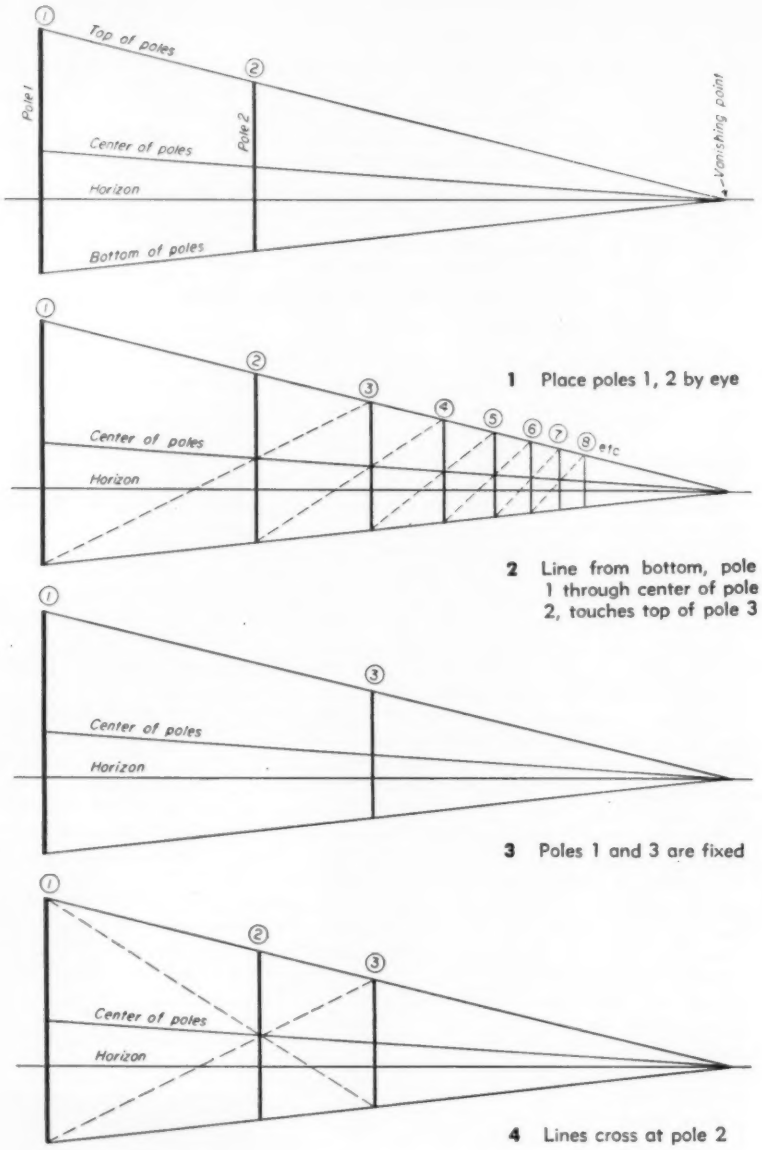
Future loads and process needs may indicate that the higher-temperature turbine, over a period of years, may be more flexible and economical than the lower-pressure alternative.



ATOMIC POWER PLANT FOR SUBMARINE, model above, will be erected in 225-ft-dia steel sphere by G E Co. Water surrounds part of hull section

There's No Trick to Spacing Poles In Perspective

When you use this logical, step-by-step method that one practical engineer suggests



► WE ARE INDEBTED to T C Rathbone, chief engineer of machinery division of Fidelity & Casualty Co of New York, for a logical method of locating a row of equally spaced poles (or equivalent) in perspective. It all started when Rathbone checked our spacing of the poles we sketched in POWER, Sept 1952, p 156. He wrote in to point out a slight spacing error in our sketch.

While his correction in no way affects the facts we presented regarding cabinet projection, we do feel that some readers will be interested in knowing how to space poles, or other objects, correctly in perspective. Here's how, in our own words:

Suppose, Fig. 1, you place poles 1 and 2 by eye to suit yourself. Draw lines (all converging to the vanishing point) locating the tops, bottoms, and centers of poles.

Next, Fig. 2, draw a line from the bottom of pole 1 through the center of pole 2. Pole 3 must fall where this line cuts the line of pole tops. In the same way, a line drawn from the bottom of pole 2, through center of pole 3, locates the top of pole 4, and so on, as pictured in Fig. 2.

Now let's take another case. Here the problem is to locate pole 2, where poles 1 and 3 are fixed, Fig. 3. If the poles are equally spaced on the ground, pole 2 must lie at the intersection of two wires, one stretched from the top of 1 to the bottom of 3, and the other from the bottom of 1 to the top of 3. That locates pole 2, as shown in Fig. 4.

The same methods can be used in perspective sketches of any objects lying in a straight line and equally spaced.

Hydraulic Conversion Factors for Special Pipes

To obtain velocity, velocity head or friction loss for pipes listed below, take for Schedule 40 pipe (C = 100) and multiply by factor in this table

Type of pipe	Hydraulic property	Nominal pipe size, inches ½	¾	1	1¼	1½	2	2½	3	4	5	6
Schedule 10 steel C=100	Vel	.853	.872	.916	.916	.919	.922	.881	.883	.892	.906	.910
	Vel head	.728	.754	.836	.840	.841	.842	.773	.783	.799	.826	.828
	Friction	.677	.711	.804	.808	.810	.813	.731	.746	.760	.790	.795
	Pipe ID	.674	.884	1.097	1.442	1.682	2.157	2.635	3.260	4.260	5.295	6.357
Rubber-lined Sch 40 steel C=140*	Vel	—	—	1.72	1.49	1.41	1.30	1.24	1.19	1.14	1.17	1.14
	Vel head	—	—	2.97	2.23	1.97	1.67	1.54	1.40	1.29	1.36	1.29
	Friction	—	—	2.02	1.42	1.22	1.01	.907	.814	.734	.782	.733
	Pipe ID	—	—	.799	1.130	1.360	1.817	2.219	2.818	3.776	4.672	5.690
Saran lined Sch 40 steel C=140	Vel	—	—	2.33	1.68	1.44	1.50	1.31	1.24	1.23	—	1.23
	Vel head	—	—	5.43	2.85	2.06	2.25	1.72	1.55	1.52	—	1.51
	Friction	—	—	4.21	1.91	1.29	1.44	1.04	.916	.894	—	.889
	Pipe ID	—	—	.687	1.0625	1.344	1.687	2.156	2.750	3.625	—	5.469
Uscolite (U. S. Rubber Co) C=140	Vel	1.29	1.23	1.20	1.17	1.15	1.13	—	—	—	—	—
	Vel head	1.69	1.52	1.44	1.36	1.33	1.29	—	—	—	—	—
	Friction	1.01	.895	.842	.779	.759	.733	—	—	—	—	—
	Pipe ID	.55	.742	.96	1.278	1.50	1.94	—	—	—	—	—
Saran & Parian (Amer Hard Rubber Co) C=140	Vel	1.29	1.23	1.20	1.17	1.15	1.13	1.18	1.16	1.15	—	—
	Vel head	1.69	1.52	1.44	1.36	1.33	1.29	1.38	1.36	1.33	—	—
	Friction	1.01	.895	.842	.779	.759	.733	.800	.781	.758	—	—
	Pipe ID	.546	.742	.957	1.278	1.500	1.939	2.277	2.842	3.749	—	—
Hard Rubber (Amer Hard Rubber Co) C=140	Vel	1.54	1.44	1.25	1.22	1.26	1.22	1.20	1.24	1.15	1.12	1.16
	Vel head	2.40	2.07	1.57	1.49	1.58	1.47	1.45	1.55	1.33	1.27	1.35
	Friction	1.55	1.30	.932	.870	.933	.863	.847	.916	.758	.721	.776
	Pipe ID	.500	.687	.937	1.250	1.437	1.875	2.250	2.750	3.750	4.750	5.625

* ⅛-in. linings for 4 in. and under; 3/16-in. linings for 5 and 6 in.

► THIS TABLE is based on the following relations: (1) velocity is inversely proportional to the area or pipe diameter squared (2) velocity head is proportional to velocity squared, or inversely proportional to the pipe diameter to the fourth power (3) friction loss is inversely proportional to the roughness coefficient C to the 1.85 power and pipe diameter to the 4.87 power (Williams and Hazen formula). C is usually taken as 100 in designing steel and cast-iron pipes. Most tables are based on this value for piping calculations.

Inside diameters listed in the table are those currently used by manufacturers, such as American Hard Rubber Co and the United States Rubber Co. The roughness coefficients are those usually assumed for the particular material in question. Blank spaces indicate sizes in which a complete line of pipes and fittings is not currently being manufactured.

Although the materials listed are in wide use at present, these factors apply to any pipe having the same inside diameter and roughness coefficient.

Problem: Find the friction loss through 350 ft of 1½-in. Saran-lined steel pipe carrying 30 gpm of water.

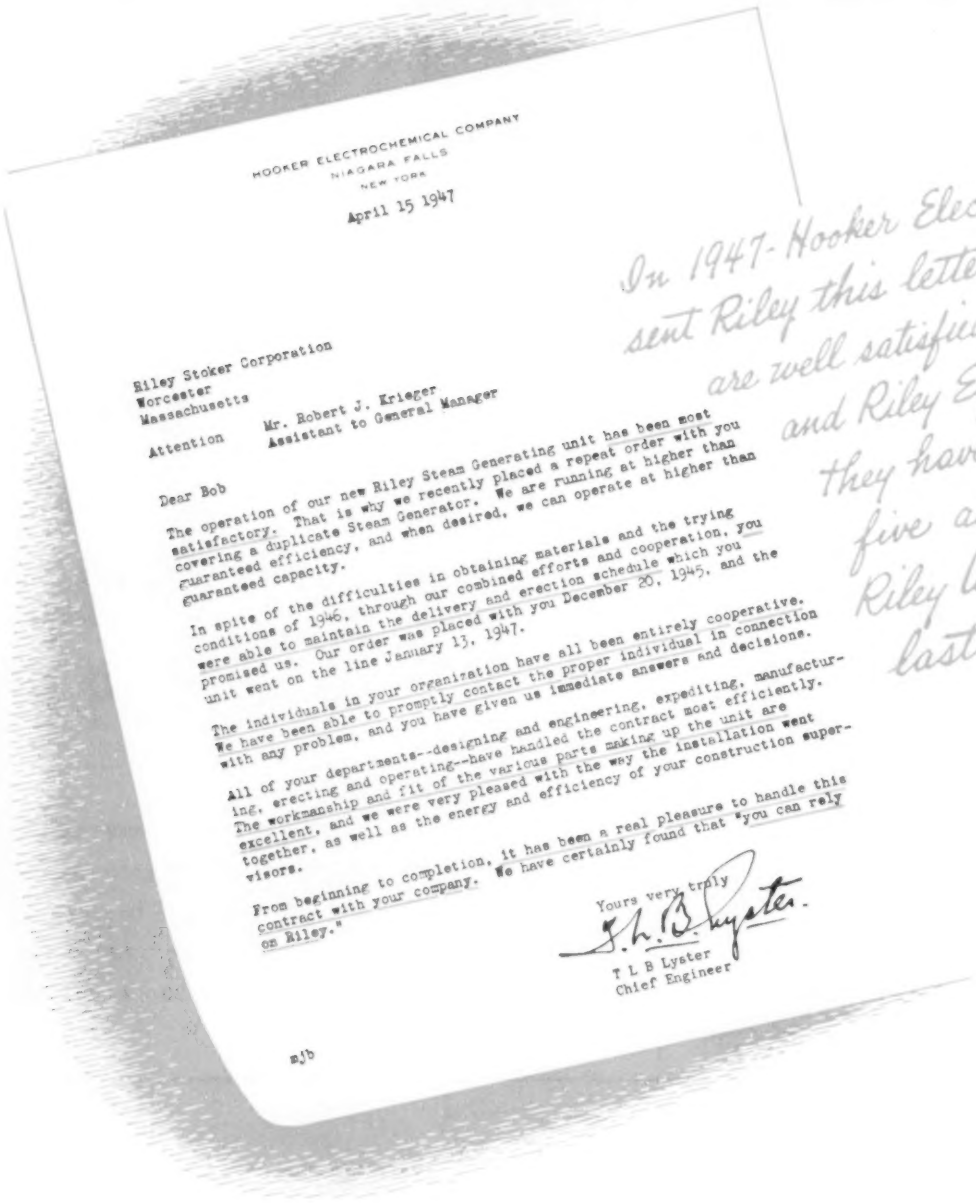
Solution: From *Cameron Hydraulic Data* or *Permutit Data Book*, or other table, loss per 100 ft of 1½-in. Schedule 40 pipe, C-100, is 11.1 ft. From table above, correction factor is 1.29. Then:

$$\text{Friction loss} = \frac{350}{100} \times 11.1 \times 1.29$$
$$= 50.1 \text{ ft}$$

BY STANLEY LENOX *The Permutit Co*

© POWER

Since their first unit went on the line in 1947



HOOKER ELECTROCHEMICAL COMPANY
NIAGARA FALLS
NEW YORK

April 15 1947

Riley Stoker Corporation
Worcester
Massachusetts

Attention Mr. Robert J. Krieger
Assistant to General Manager

Dear Bob

The operation of our new Riley Steam Generating unit has been most satisfactory. That is why we recently placed a repeat order with you covering a duplicate Steam Generator. We are running at higher than guaranteed efficiency, and when desired, we can operate at higher than guaranteed capacity.

In spite of the difficulties in obtaining materials and the trying conditions of 1946, through our combined efforts and cooperation, you were able to maintain the delivery and erection schedule which you promised us. Our order was placed with you December 20, 1945, and the unit went on the line January 13, 1947.

The individuals in your organization have all been entirely cooperative. We have been able to promptly contact the proper individual in connection with any problem, and you have given us immediate answers and decisions.

All of your departments--designing and engineering, expediting, manufacturing, erecting and operating--have handled the contract most efficiently. The workmanship and fit of the various parts making up the unit are excellent, and we were very pleased with the way the installation went together, as well as the energy and efficiency of your construction supervisors.

From beginning to completion, it has been a real pleasure to handle this contract with your company. We have certainly found that "you can rely on Riley."

Yours very truly
T L B Lyster
Chief Engineer

mjb

In 1947- Hooker Electrochemical sent Riley this letter. They still are well satisfied with Riley and Riley Equipment- they have ordered five additional Riley Units- the last in 1952.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

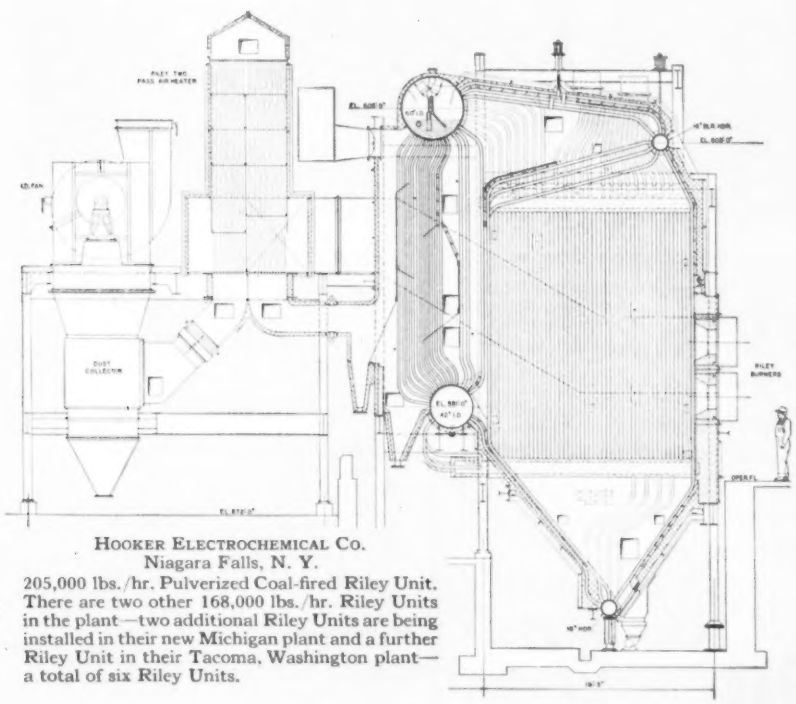
Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Charlotte Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

Hooker Electrochemical have ordered five more RILEY Units . . .

RILEY boiler users have with gratifying regularity repeated for more Riley units when installing additional steam-generating units. The accompanying tabulation lists but a few of the companies which have repeatedly placed orders for Riley units. This refusal of Riley users to accept something almost as good tells a significant story of the satisfactory performance of Riley units.

The good engineering and distinctive design characteristics of Riley units assure high operating efficiency dependable trouble-free operation over long periods with negligible maintenance. Users of Riley equipment know you can rely on Riley. It will also pay you to thoroughly investigate Riley equipment when installing additional boilers.



HOOKER ELECTROCHEMICAL CO.
Niagara Falls, N. Y.
205,000 lbs./hr. Pulverized Coal-fired Riley Unit. There are two other 168,000 lbs./hr. Riley Units in the plant—two additional Riley Units are being installed in their new Michigan plant and a further Riley Unit in their Tacoma, Washington plant—a total of six Riley Units.

This record of repeat orders for Riley Units is sound proof of the dependability of Riley Equipment

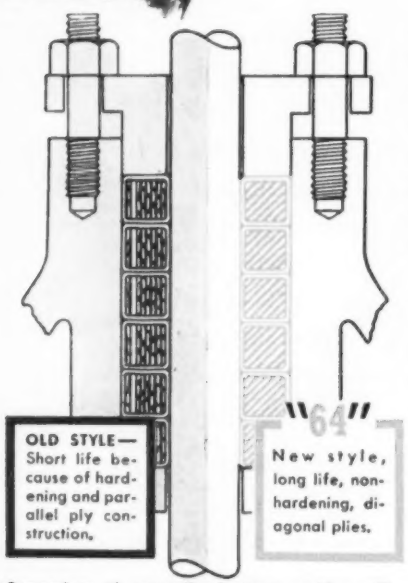
CELANESE CORP. OF AMERICA	15 Orders
DOW CHEMICAL COMPANY	13 Orders
CARBIDE & CARBON CHEMICAL	13 Orders
ALLIS CHALMERS MFG. CO.	6 Orders
CENTRAL OHIO LIGHT & POWER CO.	6 Orders
GULF POWER COMPANY	4 Orders
CENTRAL ILLINOIS LIGHT CO.	5 Orders
HOUSTON LIGHT & POWER CO.	9 Orders
ESSO STANDARD OIL CO.	7 Orders
IOWA-ILLINOIS GAS & ELECTRIC	5 Orders
INTERSTATE POWER CO.	5 Orders
KENNECOTT COPPER CO.	6 Orders
MASONITE CORP.	6 Orders
PUBLIC SERVICE CO. OF INDIANA	4 Orders
SHELL OIL COMPANY	7 Orders
U. S. STEEL CO.	10 Orders
SWIFT & COMPANY	10 Orders
STANDARD OIL CO. OF CALIFORNIA	12 Orders
OTTER TAIL POWER CO.	6 Orders
OHIO EDISON CO.	4 Orders
CURTISS-WRIGHT CORP.	7 Orders
PUBLICKER INDUSTRIES	4 Orders
CONTAINER CORP.	4 Orders
BEECHNUT PACKING CO.	4 Orders
GAYLORD CONTAINER CO.	4 Orders
MONSANTO CHEMICAL CO.	4 Orders

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS


OLD STYLE—
Short life because of hardening and parallel ply construction.
"64"
New style, long life, non-hardening, diagonal plies.

Comparison of conventional steam packing with Chesterton "64"

You know that when a packing loses its resilience it ceases to be a properly functioning packing. Chesterton "64" retains its resilience because its compound, developed in place of conventional rubber cement, resists deterioration and hardening due to extreme temperatures.

"64" has patented diagonal construction which requires less gland pressure, generates less friction and as a result "64" lasts for years.

Get a box of "64" from your listed distributor or any industrial jobber. All Chesterton products are sold with a money back guarantee.

Chesterton "64"

PACKING Chesterton SERVICE

A. W. CHESTERTON CO., 6 Ashland St., Everett 49, Mass.

In appreciation of your reading this advertisement we want to send you absolutely free a beautiful Chesterton inscribed, metal cap pen and engineers notebook. Just mail this coupon. No obligation whatsoever.

NAME _____ TITLE _____

COMPANY _____ STREET _____

CITY _____ STATE _____

WHERE TO BUY
CHESTERTON PACKINGS

Alabama
Turner Sup., Mobile
Wimberly & Thomas Birm.

Arizona
Geo. S. Thomson, Phoenix

Arkansas
A. S. Kelly, West Helena
McKee-Pitts, Fort Smith

California
Mission Pipe & Sup, San Diego
Victor Belt. & Rub., Los Ang.
Holz Tire & Rub., Lodi
Valley Pipe & Sup., Fresno
Western Ind. Sup., Sacr.

Colorado
Chas. A. Scieren, Denv.

Connecticut
Lindquist Hdw., Brdpt.
Jackson & Sequine, Hart.
C. N. Flagg, Meriden
Abel Transmission, Plainville

Florida
Farquhar Mch., Jacks.
Mine & Mill Sup., Lakeland
Railey-Milam, Miami

Georgia
Pye-Barker, Atlanta
S. Donald Fortson, Augusta
Corbin Sup., Macon

Illinois
Hagerty Bros., Peoria

Indiana
W. J. Holliday, Indpolis
Smith-Monroe, S. Bend

Kentucky
Louisville Mill Co., Louisville

Louisiana
Paul, Rice & Levy, New Orl.
Service to Sawmillers, Shreveport

Maine
Hall & Knight, Lewiston

Massachusetts
Fall River Steam & Gas Pipe, Fall River
Holyoke Valve & Hydrant, Holy.
Industrial Sup., Worc.
Robbins-Gamwell, Pitts.
Zina Goodell, Salem
Albert E Mayer, Sprng.

Michigan
Northern Hdw., Menominee
Kenneth Anderson, Detr.

Minnesota
Goodin Co., Minapolis
Duluth Plumbing, Duluth

Mississippi
John S. Stilley, Jackson

Missouri
Kansas City Rub. & Belt., K.C.
Rubber Prod. Co., St. Louis

Nebraska
Interstate Mch. & Sup., Omaha

Nevada
Sierra Mch., Reno

New Jersey
Fleck Co., Camden
Mfg. Selling, Trenton

New York
Kasper & Koetzle, Brklyn.
Root, Neal, Buffalo
Burns Piping, Syracuse
Beltran Assoc., N.Y.C.
Colerick Sup., Utica
Geo. H Cole, Troy

North Carolina
Bernhardt-Seagle, Lenoir
Gen. Fdy & Mch., Sanford
Sykes Sup. Co., Burl.
A. Lynn Thomas, Charlotte & Raleigh
Cape Fear Sup., Fayetteville

Ohio
Clark Asbestos Co., Clev.
Shaw-Kendall Eng., Toledo
Yohe Sup., Canton
Monarch Petr. Prod., Columbus
Focke Rub. Pro., Dayton

Oklahoma
Hart Ind. Sup., Okl City

Oregon
Ken McDowell Co., Portland

Pennsylvania
M. S. Young, Allentown
Perry Mill, Erie
Raub Sup. Co., Harrisburg & Lancaster
E. Keeler Co., Willsport
Bush-Miller, York
Somers, Fitler & Todd, Pitts.

S. Carolina
Sullivan Hdw., Anderson
Allen & Webb, Charleston
A. Lynn Thomas, Columbia

Tennessee
Nashville Mch. & Sup., Nash.
Browning Belt. & Sup., Knox.
Pidgeon-Thomas Iron, Memphis
Rogers-Bailey Sup., Chatt.
Summers Hdw. & Sup., Johnson City

Texas
Zork Hdw., El Paso
Hornsby Heavy Hdw, Wichita Falls
Conroe Mill Sup., Conroe

Utah
Chas. A. Schieren, Salt Lake

Virginia
Barker-Jennings, Lynchburg
A. Lynn Thomas., Richmond & Norfolk

Washington
Titan Chain Saw, Seattle
Jensen-Byrd, Spokane
Paramount Sup., Tacoma

Wisconsin
Shadbolt & Boyd, Milw.

Canada
Gordon-Belyea, Vancouver
Crown Mech. Pggs., Montreal
John Clouston, St. John's, Nfld.

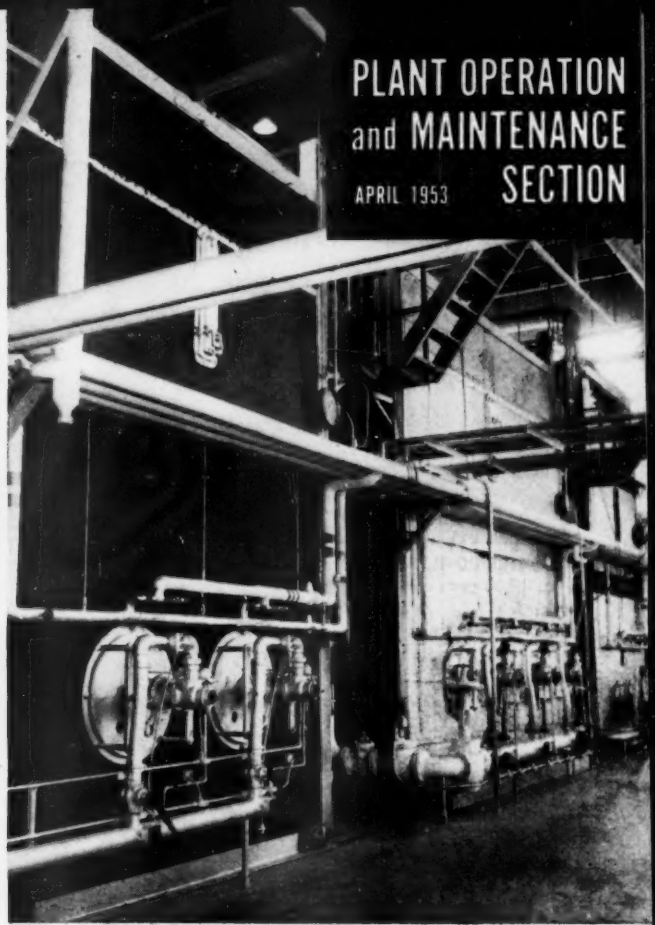
Hawaiian Islands
P. S. Peil & Co. Ltd.—Honolulu

Alaska
Northern Supply Co.—Anchorage

PLUS
Agents in all Foreign Countries

A. W. CHESTERTON CO.
6 ASHLAND ST., EVERETT 49, MASS.

AMERICA'S OLDEST MANUFACTURER OF MECHANICAL PACKINGS



Poor Operation Brings On Replacements

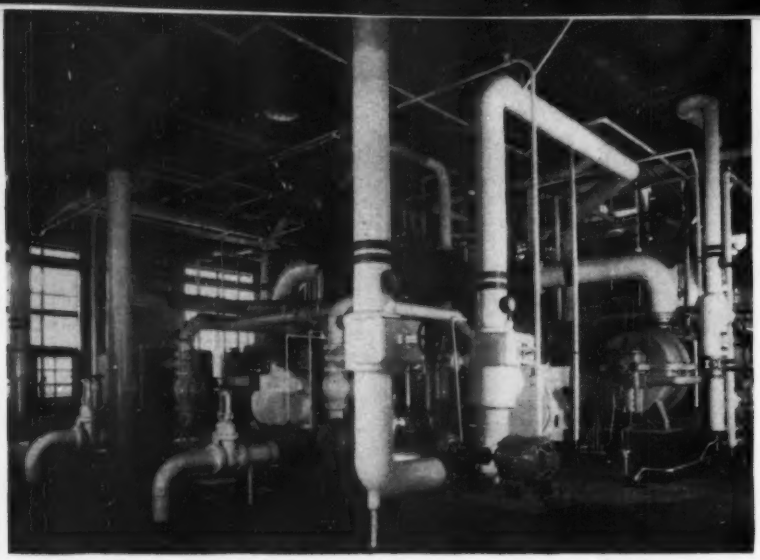
- *Inability to recognize or understand the need for suitable water supply to boilers crippled old plant's output*
- *Faulty maintenance and operating techniques allowed vents and traps to plug up, badly hampered performance of autoclaves, other equipment*
- *Improper loading, frequent pump breakdowns made all boiler-room repairs emergencies, and operation almost a makeshift*

By **MATT JONES**, *Formerly Chief Engineer, Baylor Hospital*

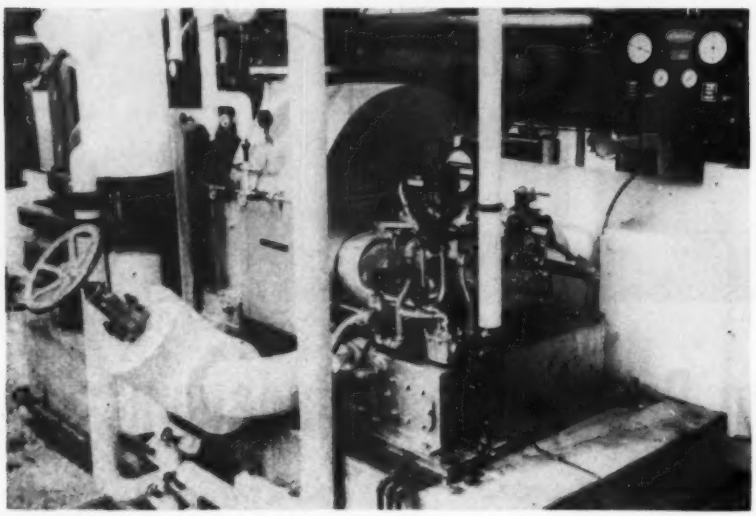
► THE BAYLOR HOSPITAL'S power plant, in Dallas, Texas, is a model of the up-to-date engineering going into new institutional buildings. But behind this particular installation lies a background of heavy maintenance problems and make-do operation in the old powerhouse, which I took over as chief engineer in 1948. Major culprit, by far, was water treatment or the lack of it. In a minute we'll see why.

Today, we know full well that Dallas sits right in that large area, extending along the southern Atlantic Coast west to southern Louisiana and Texas, that has its underground waters loaded with bicarbonates, table on p 106. Under no conditions is it suitable for boiler-water service without treatment. Yet the old boiler plant tried it and limped along for years!

Before and after photos on this page



CENTRIFUGAL, steam-turbine-driven refrigerating machines can supply as much as 1800 gpm chilled water at 36 F to individual buildings' air-conditioning systems



COMPACT, modern steam turbines, with connected shell and tube condensers, give an efficient, low-cost power generation, with a minimum of operating attendance

HOPELESS operating and maintenance problems in old plant show in this photo of badly neglected watertube boiler, choked by boiler scale and piping fouled-up

show more than the new and the old. They picture the complete revolution that institutional buildings have undergone in planning their engineering services. The old "necessary evil" days for power plants look like they're a thing of the past. Here, though, are some of the terrific penalties poor water conditions laid on the old plant. Read them and you'll appreciate why we went all out on the new powerhouse.

Boiler scale was so heavy and build-up so fast the operators couldn't keep up with it. As recently as 1948, boilers were shut down for cleaning only when they were so clogged up they couldn't produce effectively any more. Under the old system it had to be that way—we would just finish a clean-up job on one boiler when the next one would break down. When I first took over as chief engineer there were scale build-ups that reached a solid foot of honeycomb on front and back headers because of leaky handhold plates—enough to push doors partly open, photo, p 105.

Return lines were just as sorely in need of attention. When the bicarbonate-loaded feedwater broke down under boiler heat, CO_2 carried over at a merry clip into steam mains and showed up in a dangerously low pH return water. Return lines looked like they had a prime coat of red lead. Every time a maintenance man went out to replace a nipple he'd wind up putting in a whole new section.

But because we had the new plant under way the State Boiler Inspection Division, which had condemned the old boilers, let us continue running them. By dint of heavy blowdown and a make-shift water treatment we got by.

New Plant. In February 1949, we cut out the old and turned on the new power plant. The boiler-room gang

Typical Raw Water From Wells in Dallas Area

Calcium	82	
Magnesium	38	
Total hardness	120	
Sodium & potassium	518	
Total cations		638
Sulfate	8	
Chloride	170	
Mineral acid ions	178	
Bicarbonate	460	
Carbonate		
Hydroxide		
Total anions		638

PRINCIPAL POWER-PLANT EQUIPMENT

Baylor Hospital, Dallas, Texas

STEAM-GENERATING EQUIPMENT:

Boilers, 2 ..... Babcock & Wilcox Co
1, watertube, Type H, 3-drum, 6018 sq ft heating surface
1, watertube, Type H, 3-drum, 4150 sq ft heating surface
Boiler, 1 ..... Erie City Iron Works
Watertube, 3-drum, 3000 sq ft heating surface
Feedwater heater, 1 ..... Condenser Service & Engineering Co
Fuel-oil pumping equipment, complete assembly Ray Oil Burner Co
Water softener, 1 ..... Elgin Softener Corp
Cooling tower, 1 ..... The Marley Co
Combustion controls and burners ..... Webster Engineering Co

BOILER INSTRUMENTS:

CO_2 meters ..... Hays Corp
Draft gages ..... Republic Flow Meters Co
Flue-gas recorder ..... The Foxboro Corp
Boiler steam flowmeters ..... Brown Instr Div, Minneapolis-Honeywell Regulator Co
Turbine steam flowmeters ..... Republic Flow Meters Co
Master steam-pressure recorder ..... Brown Instr Div, Minneapolis-Honeywell Regulator Co
Feedwater-temperature recorder ..... The Foxboro Co

TURBINES AND ACCESSORIES:

Turbines, 2 ..... Westinghouse Electric Corp
One, 953 hp, Type C325, trip speed, 4400 rpm
One, 457 hp, Type C325, trip speed, 5850 rpm
Turbines, 4 ..... Coppus Engineering Corp
Two, 2 hp, Type TF-9, 3500 rpm; two, 1½ hp, Type TF-9, 3500 rpm
Steam condensers ..... Kewanee-Ross Corp
Steam jet ejectors ..... Kewanee-Ross Corp
Atmospheric relief valves ..... Atwood & Morrill Co

AIR-CONDITIONING EQUIPMENT, PUMPS, COMPRESSORS:

Refrigeration machines, 2 ..... Carrier Corp
One 835-ton unit, complete; one 400-ton unit, complete
Centrifugal pumps, 9 ..... Allis-Chalmers Mfg Co
One 2½x2½, condensate, 5-hp motor
One 10x10, condensate, 100-hp motor, 2505 gpm, 90-ft head
One 6x6, condensate, 40-hp motor, 1200 gpm, 90-ft head
One 8x6, chilled water, 60-hp motor, 1350 gpm, 120-ft head
One 4x3, chilled water, 30-hp motor, 600 gpm, 120-ft head
Two 2½x1¼, hotwell (steam turbine driven), 30 gpm, 25-ft head
Two 1¼x1¼, hotwell (steam turbine driven), 15 gpm, 25-ft head
Feedwater pumps, 2 ..... Worthington Corp
10x7x10, steam-driven, duplex
Condensate pump, 1 ..... Union Steam Pump Co
5¼x3½x5, steam-driven, duplex
Air compressors, 2 ..... Worthington Corp
8x7, including aftercoolers
Air compressors, 2 ..... Reliance Electric & Engineering Co
20 hp, 208 v, 3 ph, 60-cycle motors

ELECTRICAL CONTROLS, METERS:

Switchboard and breakers ..... Suare D Co
Starters ..... Allen-Bradley Co
Volt and ampere meters ..... Roller-Smith
Kwhr meter ..... Westinghouse Electric Corp
Transformers, 2, 300 kva, air cooled ..... Sorgel Electric Co

VALVES, GAGES, THERMOMETERS:

Miscellaneous sizes, globe, gate, straight and angle types ..... Crane Co; Walworth Co; Stockman Valves & Fittings Co
Blowoff valves, boilers ..... Everlasting Valve Co
Safety valves, B&W boilers ..... Crosby Steam Gage & Valve Co
Safety valves, Erie City boilers ..... Consolidated-Ashcroft Div, Manning, Maxwell & Moore Co
Water columns and prismatic glasses ..... Reliance Gage Column Co
Pressure-reducing valves ..... Spence Engineering Co
Excess-pressure regulators, feed pumps ..... McAlear Mfg Co
Boiler-water regulators ..... The Swartwout Co
Fuel-oil storage-tank gages ..... The Liquidometer Corp
Boiler gages..Consolidated-Ashcroft Div, Manning Maxwell & Moore Co
Gages, all others ..... Crosby Steam Gage & Valve Co
Thermometers ..... Weksler Thermometer Corp

MISCELLANEOUS EQUIPMENT:

Traps, strainers ..... Sarco Co
Lubricators ..... McCord Corp
Hot-water generator ..... American District Steam Co

CONTRACTORS:

Architects and engineers ..... Thomas, Jameson & Merrill
General contractors ..... Inge, Hayman Constr Co
Consulting engineers ..... Zumwalh & Vinther
Plumbing and heating ..... C Wallace Plumbing Co
Electrical contractors ..... Superior Electric Co

---

gathered up their belongings and moved bag and baggage to the new plant. One of the fellows was so impressed when we reached the "palace" he took off his shoes and tiptoed to the locker room.

Primary purpose of the new plant is to furnish steam, air and chilled water through a 6x4-ft, 1060-ft-long tunnel to a new dental college, the Truett Memorial Hospital, Baylor Hospital, Florence Nightingale Maternity Hospital, a library building and a 5-story nurses' home.

The power plant houses three 3-drum watertube boilers (see Equipment Table), equipped with automatic-control natural-gas burners plus manually-operated standby oil burners. Results have been first rate. Plant runs with a CO_2 range of 8-10.5% burning natural gas.

Furnaces are solid-wall construction; no soot blowers are needed with natural gas. Inside walls were sprayed with a high-temperature, super-duty refractory surfacing material that has worked out well. After the boilers put in a year on the line it was assumed the walls had expanded and cracks opened to the limit. We then applied a protective coating to the outside boiler settings, see photo of new boiler, p 105.

One of our troubles in the old plant had been pump-suction problems from too low a head. So this time we put an open feedwater heater, 69,000-lb-per-hr capacity, 25 ft above the pumps. In addition, automatic controllers hold the water level constant within the heater at a point well above this 25-ft level. The condensate pump takes its suction from a 6x12-ft surge tank that receives all pumped returns from the buildings.

Instrument Board. As you might guess, the new plant features all necessary instruments, see equipment table. It has two panelboards—a main one in the boiler room and a smaller one spotted near the turbines.

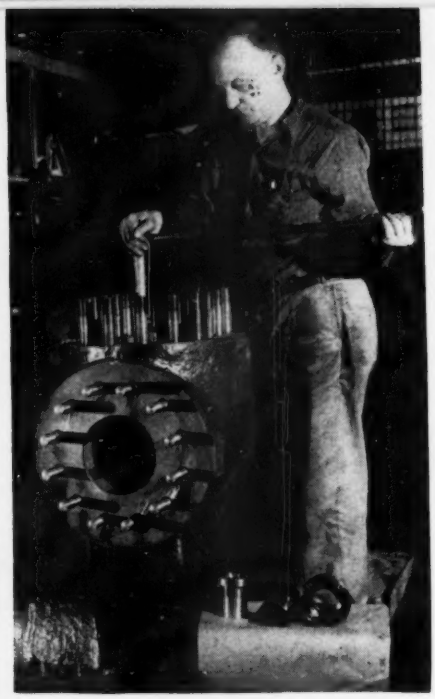
Water treatment, of course, receives full attention. Our water supply now comes from city mains. It is led through two sodium zeolite tanks to reduce its average incoming hardness of 5 gr per gallon to practically zero. About every 430,000 gal the zeolite has to be regenerated to keep it at top performance.

In addition to this pretreatment soda ash and trisodium phosphate is added to the boiler water. Sodium sulfite acts as a scavenger in the feedwater to remove any traces of oxygen left after the deaerating-heater stage.

Cooling towers get daily treatments of sodium hypochlorite and sodium bichromate. The sodium hypochlorite holds the algae and fungus in check and the sodium bichromate controls corrosion in the circulating-water lines. Cooling-tower water-basin level is lowered about halfway every three months; then is refilled with softened water from the zeolite units. What's more, we use some softened water returning to the surge tank as a coolant in the air compressor aftercoolers.

All in all, Baylor's got a smooth-working plant that it's a pleasure to operate. So maybe the old nightmare did them a good turn. Without the experience it gave them, the new plant might not have been so complete.

BALANCING turbine wheel statically after it is completely banded. Balance is so important that you must guard against deposits and erosion tending to unbalance



STEAM VALVE seats are renewable. Mechanic tightens seat into the valve chest

'Regular Turbine Care Pays Big Dividends,'

says Harry Neary, Field Engineer, DeLaval Steam Turbine Co

► GOOD STEAM-TURBINE maintenance and operation pay even bigger dividends than with most equipment. I've seen operating costs climb in many plants because upkeep was neglected. Biggest fault is lack of systematic inspections, just because unit seems to run OK.

Inspect new turbine after six months to a year. Repeat every 10,000 to 12,000 operating hours, if machine runs normally at constant load with few shutdowns. If turbine is started and stopped often with high-temperature stresses from quick starting and rapid load changes, then you should inspect oftener.

Critical period is from initial start to first inspection. Then troubles from foreign material or deposits show up. That's the time to correct these headaches, at source. During this period, checking stage pressures shows if there's an unusual condition starting inside machine. Rise in stage pressure is warning to look inside.

Opening new turbine after six months to a year to check steam effect also gives idea for next inspection. I recommend you don't exceed 10,000 to 12,000 operating hours between inspections. I've seen too many headaches that could have been avoided from warning signs.

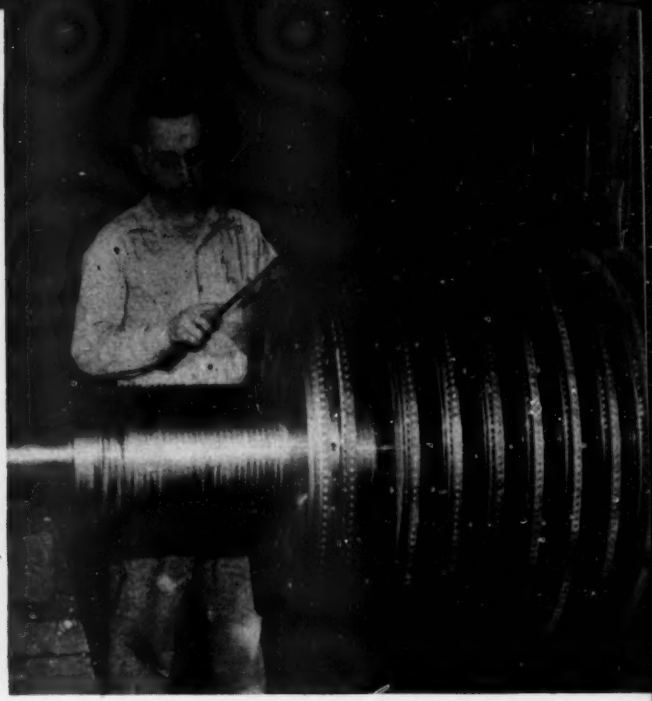
When inspecting, record turbine's internal condition, before and after repairs. Comparing records shows rate of wear. You also know replacement parts to order for next overhaul.

Steam Deposits. Because turbine's efficiency depends on high-velocity steam, slightest internal defect can be costly. Keep steam clean to prevent deposit forming on blading. Prevent blade deposits by chemically treating feed and boiler water.

Actually, very little is known about turbine-deposits formation. But research on cause and prevention goes on.

Kind of deposits also depends on steam and operating conditions. Experience shows that, in a multistage turbine, soluble deposits generally form at earlier turbine stages. Insoluble deposits form on middle and later stages. Both types of deposit restrict steam passage-

DIAPHRAGM with nozzles is moved to position. Bronze spot-weld on periphery is one of seven, helps position diaphragm



VELOCITY-COMPOUND stage of rotor is checked after being shrunk onto shaft. Holes through disks equalize pressures

ways, raise pressure drop across coated stages. That changes energy distribution in turbine, causing efficiency and capacity drop. It also raises loading of stationary elements, which distort and deflect, causing rubbing and internal damage.

About most useful way to know performance of multistage turbine is to check stage pressures periodically. Stage-pressure readings can indicate if deposits are building up in stage nozzles. To analyze these readings, know steam conditions at turbine inlet, steam flow and load during these checks.

Plot an absolute-pressure curve of stage pressures against steam flow. Do this when turbine is first installed, then right after repairing internal parts. Curves help find changes taking place inside.

To analyze periodic readings, compare first-stage pressure and steam-flow requirements with original readings. Make this comparison when steam inlet conditions to turbine are within close limits to inlet steam conditions obtained for base results.

Deposits on turbine stages gradually raise stage pressures. Ask your turbine maker what stage pressures show steam passages need cleaning.

As soluble deposits form at earlier stages, and insoluble deposits at middle stages, take stage pressures on all multistage turbines at first stage (pressure on second-stage nozzle) and at saturation stage. Get right location and pressure at these stages from manufacturer.

Soluble deposits cause just as much trouble as insoluble. Washing is only thing that removes them.

Remove water-soluble deposits by reducing inlet temperature enough to produce wet steam at first stage. Then moisture washes off deposits.

Reduce temperature by desuperheating steam with a temporary desuperheater in line. Or admit water from feed pumps through a spray nozzle after the throttle valve. Place nozzle in turbine's steam line or steam chest.

While washing, run turbine at reduced speed. Control by throttle valve to prevent damage. Trouble is from sudden temperature drop, allowing slugs of water to blast blades. Slugs can really wreck moving blades. Analyze hotwell condensate often while washing. That gives character of removed deposits. You then know when deposits are washed away.

Water-insoluble deposits don't remove easily. Usual way is to tear down unit and blast deposits with flyash or other abrasive. Blasting runs up labor costs and capacity outage. That increases turbine's operating costs.

Some larger utilities remove water-insoluble deposits by washing turbines with a 10% caustic solution. Inject solution into turbine's steam chest with enough steam to roll turbine slowly. Caustic may cause caustic embrittlement. There's always danger of releasing a lot of deposit at one time. Then turbine's rotor gets serious damage when returned to service. This is from unbalance caused by incorrect washing. Caution: Turbine washing takes highly skilled men, especially trained for analyzing conditions during washing.

Lube Oil. Right lube-oil care in service is highly important. Turbine oil must lubricate, operate hydraulic devices, dissipate heat and protect metal surfaces from corrosion.

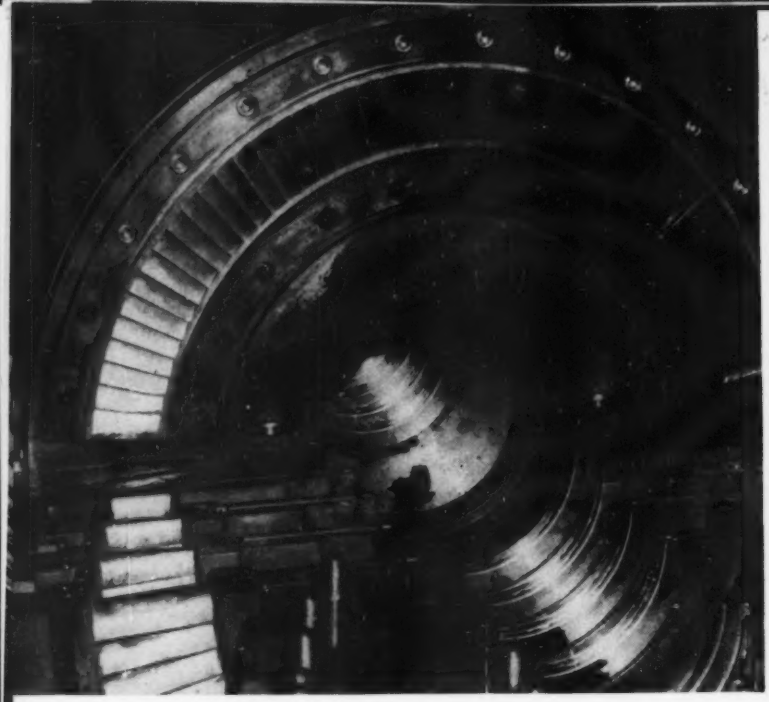
To provide these qualities without sacrificing one for another, lube oil needs definite physical properties. These needs vary with speed, bearing loading, and type of service. Turbine-oil refiners, working with turbine firms, developed such oils.

Water in oil causes corrosion and breaks down lubricating properties. Keep water out when unit is idle and when it's running. Water settles when oil is quiet—corrodes surfaces it touches.

Water enters oil from three sources: (1) leakage in oil cooler, especially when equipment is shut down or circulating-water pressure is higher than oil pressure in cooler (2) steam from turbine packings blowing into bearings (3) condensation of moisture from atmosphere.

Leakage in oil cooler is most dangerous. Test cooler often so you can repair promptly. Some water will enter oil through sources 2 and 3. Water and sludge formed collects in bottom of drain tank. So pump out often with purifier, or drain to waste sump.

If a lot of water enters system (large leak in cooler), shut down turbine, drain all oil in system and purify. Re-



EXTRACTION nozzle plate for automatic extraction at 5-20 psig from fifth stage. Labyrinths are springloaded, held in diaphragm shoulders

NOZZLE-RING and reversing-bucket assembly Allen-screwed into top half of the turbine casing

Periodic Checks Will Save You Costly Maintenance

pair leak, fill system with clean oil before starting turbine.

Dirt and grit in oil abrades bearings and wears all other working parts oil services. To prevent dirt entering, keep bearings and all openings covered except when you can't avoid it during repair. Keep oil tanks closed with covers bolted down. At best, some dirt and dust will get in. There are also bits of rust, scale, and results of oil decomposition. Remove often by purifying oil.

Inspect and clean oil strainers at regular intervals. Letting cleaning go may clog strainers and increase pressure drop across screen. Then screen may burst, spilling all collected dirt into bearings and governor hydraulic system.

Acid-free lube oil may become slightly acid through use. Check corrosive action once a quarter by sending oil sample (drawn from system) to lube-oil firm for analysis. If oil is acid enough to cause corrosion, replace with new oil.

Bucket Inspection. Inspect rotating and stationary buckets at each inspection period for signs of rubbing, loose buckets in fastening, broken shrouds, chipped buckets, deposits and erosion. Wear on inlet and outlet edges of rotating and stationary buckets is from wet steam or solids in steam.

Most bucket wear is often from saturation through last row because of steam's higher moisture content there. Moisture tears at bucket tips, gradually wearing them away. In time, ragged saw-tooth edges develop. File smooth at inspection time, and replace these buckets when they wear about ¼ original width.

Rotor and Stationary Element. When inspecting, get total end play of turbine rotor between striking points. Compare with original condition to see there's no obstruction causing reduction in running clearances. Set rotor from high-pressure nozzle with manufacturer's data.

Clearance gage for rotor's running position usually comes with turbine. Check rotor position once a day when turbine is running. Recalibrate clearance gage carefully after every rotor overhaul.

Years of operation, also temperature changes from starting-stopping, and load changes cause growth and distortion of turbine casing, rotor and stationary elements. If there are changes between inspections, correct by lining up rotor with stationary elements.

When first installing, and at each inspection, turn rotor slowly while indicating rims of turbine wheels. Take clearances between each wheel and diaphragms on both sides of wheel at rim.

If comparing records shows that total end play is reduced to danger point, remachine locating-tongues of diaphragms. Clearance between hub at inlet and outlet side of each turbine wheel and its diaphragms will show if diaphragm has distorted. If distorted enough to reduce total end play in rotor, you may have to rework diaphragms. Get end limits on distortion from turbine maker.

Shaft Seals. When opening turbine, inspect high-pressure and interstage labyrinths for clearance between rotating and stationary elements. Renew labyrinth if worn clearances have doubled. Straighten and scrape smooth-rolled fin-edges, to prevent cutting down rotor end play.

Recondition shaft surfaces under carbon packings if necessary. If there are shaft-protecting sleeves at these points, renew them. Otherwise, metal-spray worn surfaces and regrind shaft to original diameters.

Refit carbon rings' clearance between rings and journals to maker's recommendation. But make sure butt ends are

REMOVING SCALE from low-pressure diaphragm takes time—lots of patience

FIRST-STAGE nozzle ring is made up of series of accurately milled units shown

MEASURING SLOT for straddle T-fastening in turbine-wheel forging, with vernier

square, to avoid excessive leakage when running turbine.

Bearings. Check sleeve bearings for babbitt dragging or high spots. Then you might have to spot to shaft journals. Split bearing shells tend to spread out of round when removed from bearing housing. So it's impractical to measure bore without holding rings used in their manufacture. Use bearing housing instead of holding rings. Place four or five pieces of lead wire between top of journal and bearing. Then bolt bearing cap so wire flattens in clearance space. Remove bearing cap and micrometer thickness of flattened wire.

Thrust bearing's failure can wreck internal parts by rubbing them against each other. Dismantle bearing completely and inspect grooved or pitted thrust surfaces. Refinish if practical. Otherwise, renew parts. Inspect all oil passages. Install parts in right location and adjust clearances with shims.

Running clearance is space between rotating thrust collar and stationary thrust face. In Kingsbury thrust, housing is normally in bearing bracket with adjustable tongue and groove. There's clearance between these parts and threads on adjustable tongue and housing block to prevent movement when setting running clearance between thrust faces. Caution! I've seen turbines damaged seriously because thrust bearing was assembled incorrectly.

Coupling. Well-designed turbine has enough thrust-bearing capacity to absorb turbine thrust loads, but not extra thrust from other machines. So turbines are usually connected to driven unit through flexible coupling. Dismantle coupling at each inspection and check thoroughly. Look for wear, shoulders and galled surfaces that transmit torque. Such conditions reduce flexibility. Then thrust from driven unit may be transmitted to turbine. Clean coupling and replace worn parts.

Vibration from coupling may cause fatigue failure in rotor. That might even break shaft or wheel disks, so check alignment.

Governing System. Governor keeps uniform steam flow to turbine for right speed regulation. Dismantle governor at each inspection, check for worn or broken parts, also lost motion and friction in transmission. Replace all questionable parts. When taking apart, note settings of all adjustable elements.

When reassembling, check all parts for tendency to bind. Stone or crocus-cloth such parts. Don't polish governor parts too much, or you'll have lost motion.

Governor valves are directly controlled by governor, either mechanically or hydraulically. In either case, freely operating valves are important. During inspection, renew packings on steam chest or on hydraulic system. Use right packing. Check all rods for straightness and smoothness. Tight packing glands have caused valve rods to bend and gall from force transmitted by governor.

Emergency Governor. Overspeed governor prevents dangerous overspeeding. This trips either throttle valve or an emergency stop valve, shutting off steam when turbine reaches 110% of rating. Give this device as much attention as boiler safety valve or any other safety device.

If test shows that governor doesn't work right, shut turbine down immediately. At inspections, examine governor and tripping mechanism, including valve. When reassembling overspeed device, test tripping mechanism by hand before admitting steam to turbine. Check governor operation several times by overspeeding turbine to design tripping point. Use tachometer for overspeed test.

Corrosion. Serious cause of corrosion during idle period is improper seating of sealing, drains, throttle and header valves. They allow steam to leak into turbine to condense. Regrind or renew if renewable type, test for tightness.

Circulate oil through unit a few minutes every day. While circulating oil, turn unit through 1¼ revolutions so bearing surfaces are oiled and rotors come to rest in new positions.

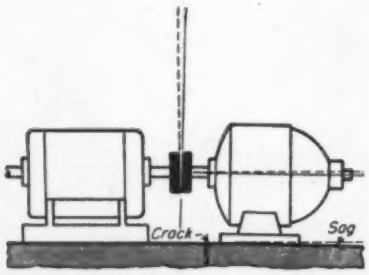
Factory Service. Best man to inspect a turbine and supervise its repairs is usually manufacturer's service man. He's not a cure-all, but he is backed by factory's engineering department. That makes cost of his services a good investment.

But whatever you do, don't expect trouble-free service from your turbine, year after year, just because it keeps running. Follow suggestions given here.

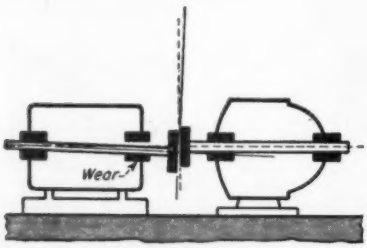
OPERATORS' NOTEBOOK 62

Aligning Couplings and

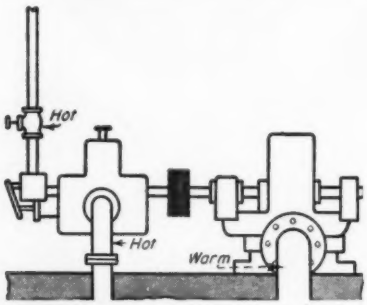
Why You Must Check Couplings



FOUNDATION SAG may not be evident to the naked eye, but vibration, building settling, etc, lower or change level of machinery, wearing the flexible couplings

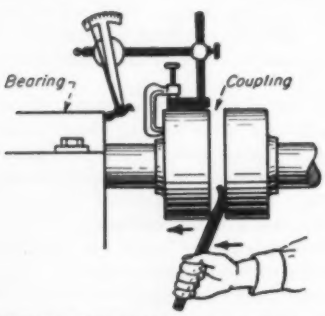


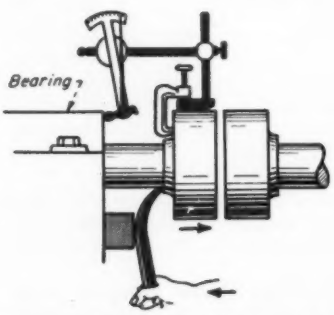
BEARING WEAR may be uneven. Then most accurately aligned equipment gradually gets out of line. That wears contact surfaces of even best-designed coupling



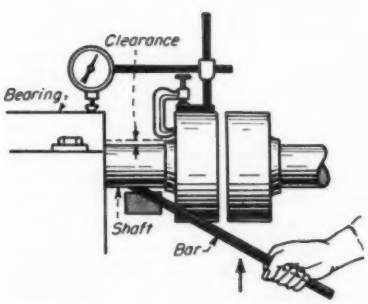
EXPANSION or contraction from hot, then cold piping often pushes equipment out of line. Lining up cold machinery does not mean it will be aligned when hot

Handy Uses for Indicators



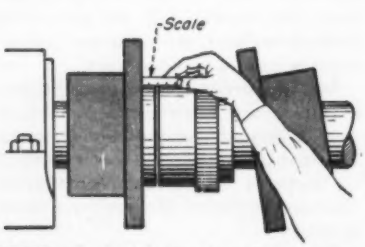


THRUST CLEARANCE or end play in most rotary equipment is highly important. If this clearance is excessive, vital parts, like rotors of turbines or pumps, rub on casing, causing costly damage. To check end-play without taking equipment apart, break coupling, then move shaft both ways while the indicator is set up as shown here

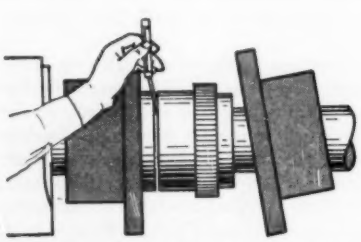


BEARING CLEARANCE (also wear) is easy to check. Break coupling, clamp indicator to coupling and rest the indicator on bearing. Not necessary to take leads

Simple Checks

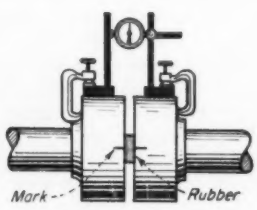


SCALE or straightedge placed across two coupling halves at four places around coupling is visual check. But indicator is much more accurate, saves costly wear



FEELERS between coupling halves at four places around circle show if shafts are aligned. But this naturally cannot be as accurate as using a dial indicator

How to Align Couplings



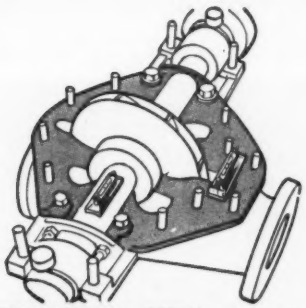
Angular check

1 Place rubber between shaft ends (not near rim) to hold halves apart. Mark halves, attach indicator as shown, turn the halves together for angular check

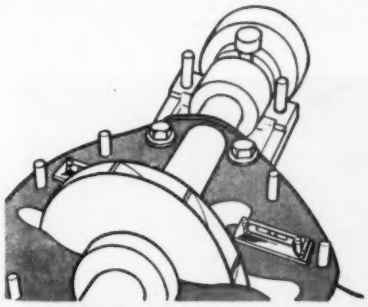
Other Handy Indicator Checks

By **STEVE ELONKA,** *Associate Editor*

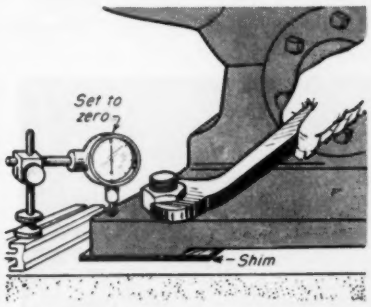
New Machine Has to Be Level



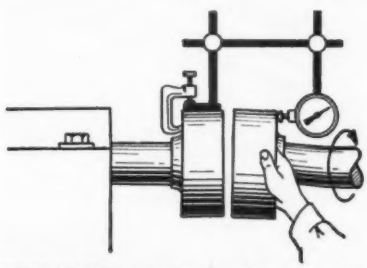
HORIZONTALLY ALIGN equipment with machinist's precision level by placing level on shaft or on machined surface. This helps parts to wear as intended



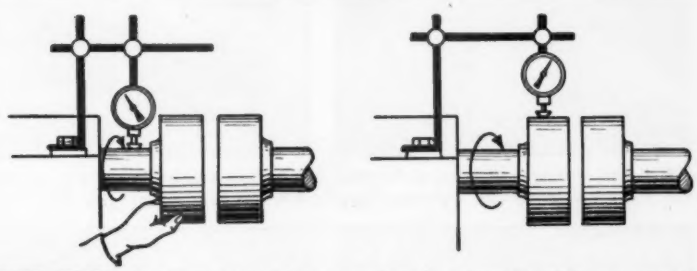
HORIZONTAL alignment also means that machine must be level in all directions. This helps in right setup of the piping and other equipment hooked to machine



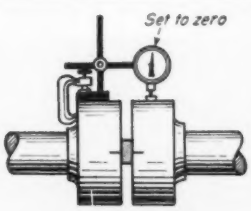
INDICATE machine base by setting gage to zero. Tighten down most rigid unit first (pump). If base springs, loosen and place shims until there's no spring



BENT SHAFT or coupling half not square is found by turning one half, while indicator is on the other. Don't assume couplings are true on shaft. Check them

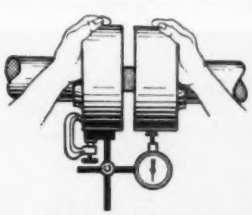


CROOKED SHAFT shows up with indicator anchored to bearing while pin touches shaft. If shaft is true, check coupling half for being true on shaft (right). If not true, hole may be eccentric to rim, or coupling may not be snug fit on shaft. Soon as you know that shaft and coupling's half are true, you can line up coupling (below)



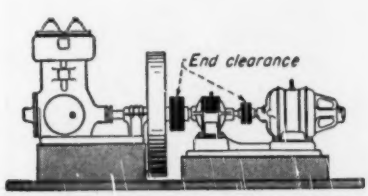
Rim check

2 For rim check, change indicator as here. Turn two halves together, watch dial. Raise machine legs same amount with shims if angular check is perfect



Figuring rim misalignment

3 With 0 reading at top and 0.020 in. at bottom; 0.020 in. divided by 2 equals 0.010 in. that one machine is out. Raise low machine with 0.010 in. shims



4 End clearance between the coupling halves must be right. If not, the worn thrust bearing or heavy rotor may load lighter motors, causing serious damage

Topnotch Pump Film

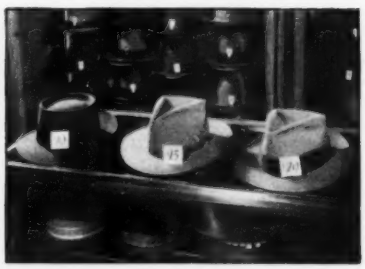
This is the third Allis-Chalmers pump film. The first two, in June and Oct POWER, covered maintenance and operating facts. Here we cover many phases of pump selection. For a complete showing of this fine talkie, contact AC

By JOHN GAMMELL, *Supervisor of Sales Training, Allis-Chalmers Manufacturing Co*

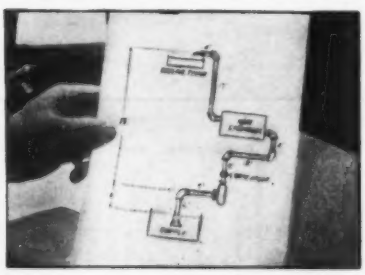
1 This film shows you an excellent way to select pumps for your plant jobs

5 Then his trusty slide rule said, "I got an idea that may give you help"

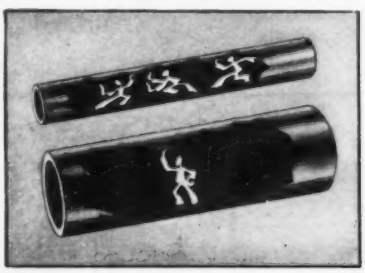
6 "How do you pick a hat?" "Well, first I settle on right size so it fits"



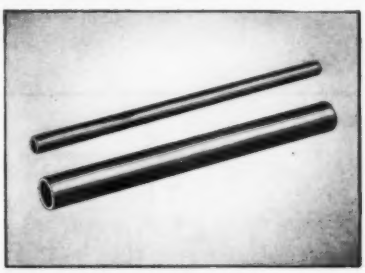
7 "Then I decide on color and style. After that I pick the best hat buy"



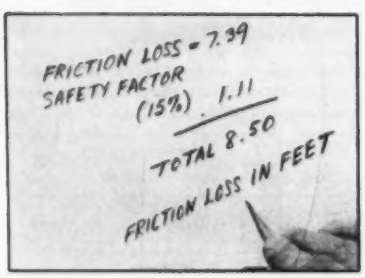
11 Pump Johnny is figuring is for this system that he has sketched here



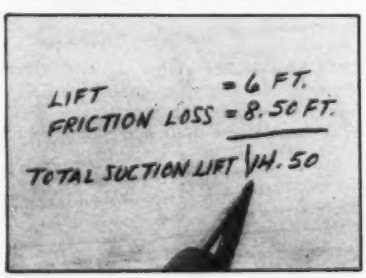
12 Pipe friction losses pile up fast, as the square of the fluid velocity



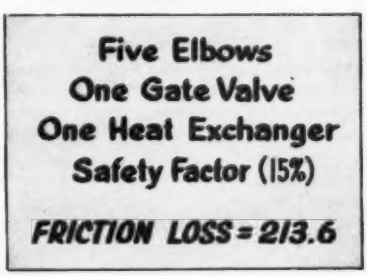
13 That's why pipe size is so important. Don't try to cut corners on the size



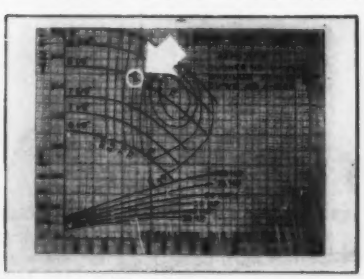
17 To this friction loss we add safety factor of 15%. Total loss is 8.5 ft



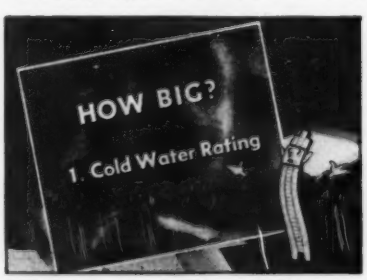
18 To the suction friction we must add the pump suction lift, which is 6 ft



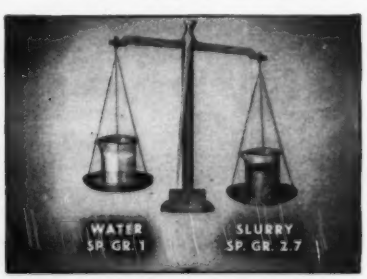
19 Discharge-side friction loss for the fittings is 213.6 ft, as shown above



23 All charts are based on handling of cold water. Once we know this we...



24 Can tackle anything else that may determine how big our pump must be



25 One factor is liquid weight. Liquid heavier than water needs more hp

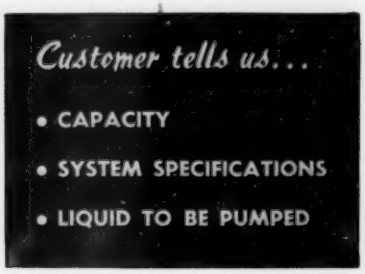
2 Johnny, a young engineer, is stuck, must pick pump right from all angles

3 He figured and figured, and though he knew his pumps he had too many

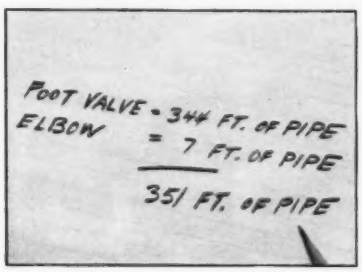
4 The pump could be an electrifugal or an SSB. Or he could use a Type S . . .

8 "It's the same with pumps," said the overworked slide rule, "and it works"

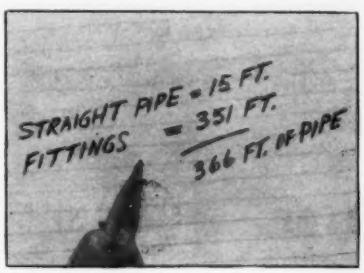
9 Your first question is how big pump must be. That is, how many gpm



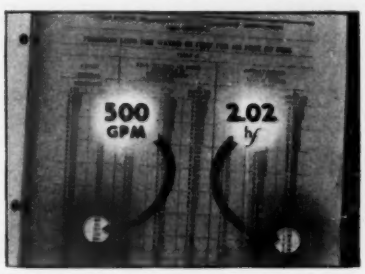
10 The man buying pump must tell maker gpm, pipe details, liquid



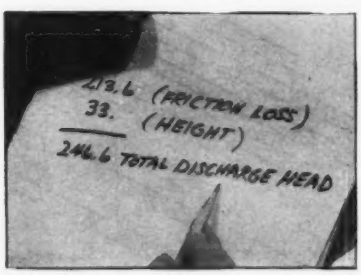
14 Figure the valve and fitting losses. The less friction, the less power



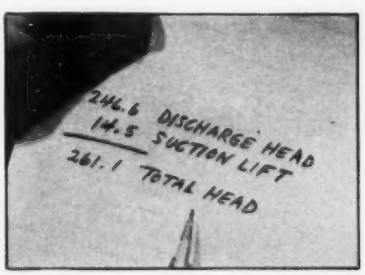
15 Figure straight-pipe loss, too. Add it to fitting loss for total loss



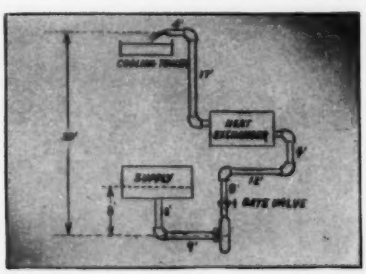
16 Standards table shows loss in 6-in. pipe is 2.02 ft/100 ft for 500 gpm



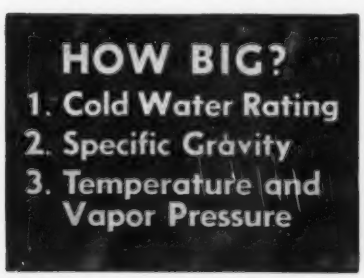
20 Add total friction loss to the net height of 33 ft for discharge head



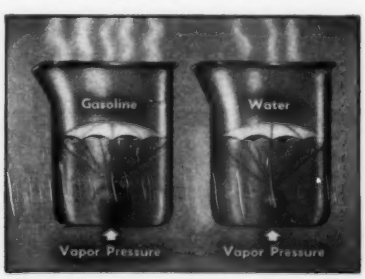
21 Total head on the pump is sum of discharge head and the suction lift



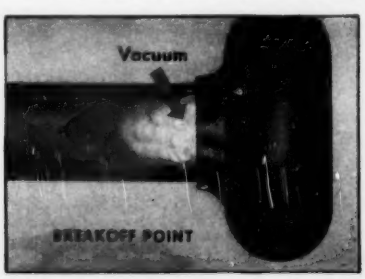
22 Of course, if supply is above pump we subtract suction from discharge



26 Factors we must consider next are liquid temperature, vapor pressure



27 All liquids tend to evaporate. Force causing this is the vapor pressure

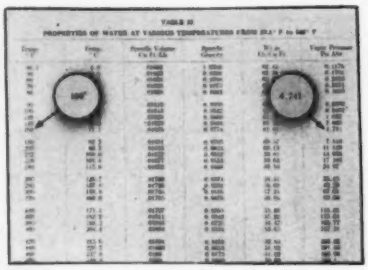


28 Higher liquid temperatures may lead to flashing and loss of pump suction

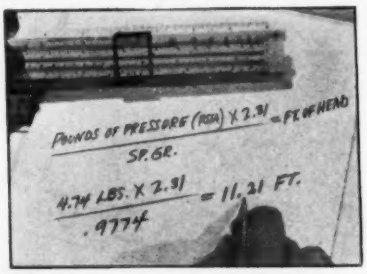
More on next page

THE SELECTION FORMULA GIVEN IN THIS ARTICLE SAVES YOU MUCH TIME AND INSURES BETTER . . .

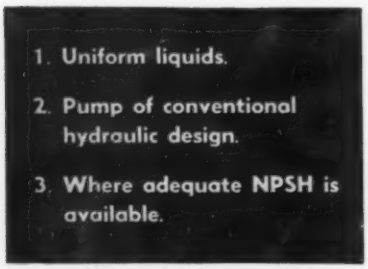
29 Figure net positive suction head (npsh) available, using pipe sketch



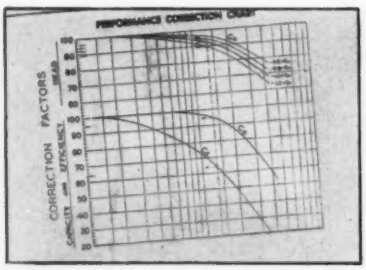
30 Then find vapor pressure of liquid at temperature it is being pumped



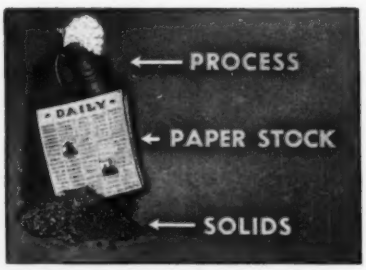
31 This is in psi; convert to feet of water as shown to obtain 11.21 ft



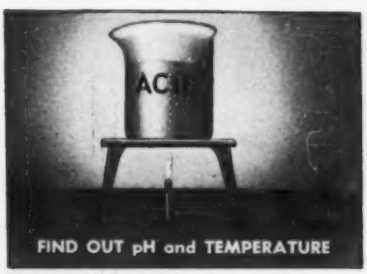
35 Viscous liquids require more hp for pumping than the nonviscous liquids



36 Use your correction chart when you pump the uniform viscous liquids

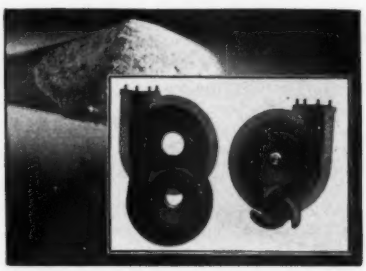


37 Some pumps handle clear water, some soft solids, others hard solids

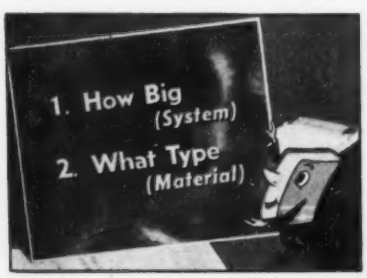


41 Don't forget—temperature and pH of liquid you pump are important

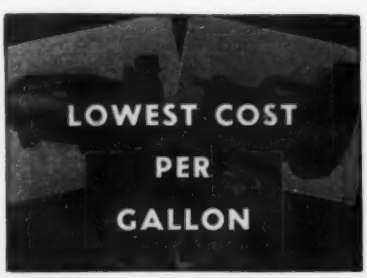
42 Some suspended solids, like taconite and sand, are hard, and are abrasive



43 Reduce pump wear by running at low speed and rubber coating parts

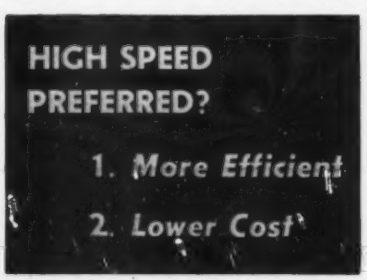


47 If you first figure how big a pump is, then what type, result is good

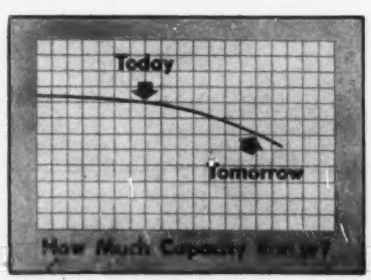


48 Best pump for you is the one that handles fluid at lowest cost per gal

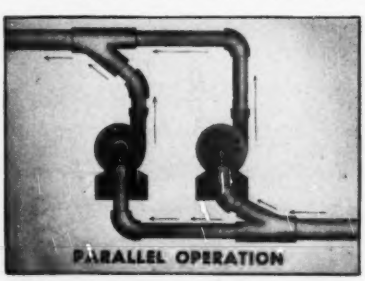
49 Be sure to tell the manufacturer if you prefer a certain type of pump . . .



53 Remember that high-speed pumps may cost less. Don't use on solids

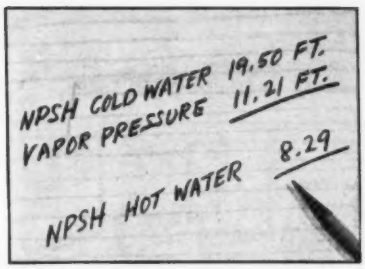


54 Pick a pump with a flat curve if you will regulate flow with a valve



55 Pumps in parallel must run at common head, have a rising head curve

. . . RESULTS IN ALL TYPES OF PUMPING APPLICATIONS. LEARN TODAY HOW TO USE IT IN THE PLANT



32 From npsh for cold water, subtract the vapor pressure, as shown above

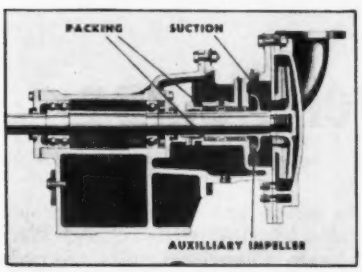
33 Now we've figured three of the four factors that tell how big pump is

34 Our last factor is liquid viscosity. It is the liquid's flow resistance

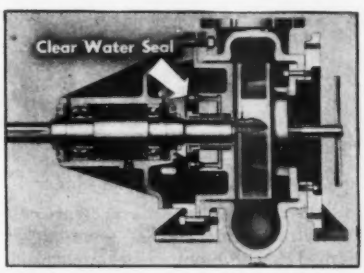
38 Acids or alkalis may be handled by the pump. The pH scale is good here

39 Use all-bronze parts for pumps that must handle the acids in your plant

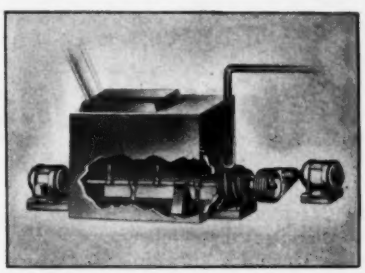
40 When pumping alkalis, all wetted parts should be iron, as shown here



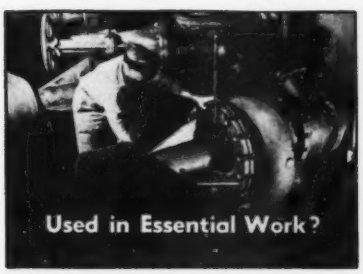
44 For small, hard solids, auxiliary impeller cuts pressure on the packing



45 And a clear-water seal helps keep the packing free of grit and dirt



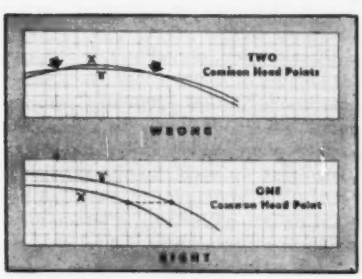
46 Pulpy solids plug suction. Usa a big pipe or special feeder to cure this



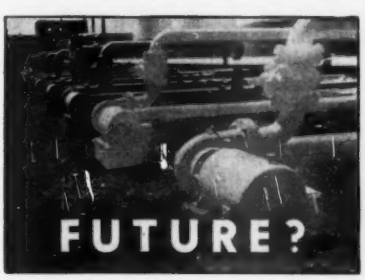
50 Or if your pump is in an essential service. It helps him to know this

51 Always buy best pump you can get because it will pay you in long run

52 But if a pump runs only a few times a day it can be a less expensive one



56 If A's curve hasn't constant rise, there may be two common heads



57 Don't overlook the future; you may need more head, more capacity then

58 Remember formula: How Big? What Type? What's the Best Buy for Me?

Film produced by Atlas Film Corp

YOU CAN DO ALL THESE THINGS:

1 Find faulty pumps

2 Clean pumps as they should be

3 Nail down unexpected troubles

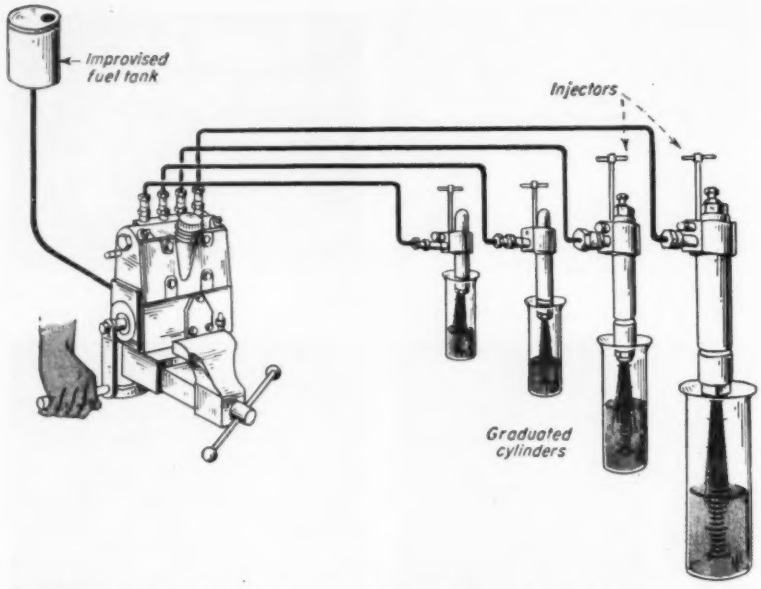
4 Grind in pump valve seats

5 Learn why pumps stick

6 Correct early or late timing

7 Stop engine misfiring

8 Calibrate pumps in your shop



1 Hold pump in vise, place graduated glass cylinders under each injector. With temporary handle on pump, crank about two minutes. Compare oil in cylinders

By C MORGAN JONES, *Diesel Engineer*

Give 'Zing' to Diesel-Fuel Pumps

► CRACKERJACK OPERATORS, who can do almost any diesel job, often shy clear of fuel pumps. They think it takes a genius to overhaul one.

Diesel engine's fuel pump is heart of the system. It takes patience, care, and the maker's maintenance manual. But a manual leaves out plenty that a practical man should know.

Most troubles in barrel- and plunger-type pumps are from damage to these two parts. Symptoms vary, but include low exhaust temperature and low firing pressure, unbalanced pump, misfiring, and engine failure to develop full power.

If engine misfires, first find missing cylinder by exhaust temperature (low reading). Or cut out each cylinder in turn by disconnecting fuel line at nozzle union or opening bleeder screw. When defective cylinder is found (misfiring ceases), remove injector and replace with a good spare. Start engine —if misfiring continues, trouble is in pump.

Clean dirt, grease, oil, etc, from pump housing with diesel fuel or kerosene. Dry. Remove faulty pump of missing cylinder. Tie covers over all open lines.

Soak hands in fuel oil. This prevents corrosion starting from sweaty hands on fine, finished surfaces. Work on linoleum-covered bench. Place all parts in bath of diesel fuel oil, acetone, carbon tetrachloride, etc, as removed. If more than one pump is being checked, keep all parts in separate, fuel-filled trays or cans. CAUTION: Remove sticking dirt with stiff bristle, NOT wire, brush.

When clean, check these pump parts with hand magnifying glass for: (1) minute lengthways scratches on plunger or barrel. If scratches are deep enough for fingertips to feel, replace barrel and plunger, Fig. 2. (2) Dull patches on bright surfaces. Remove by rubbing lightly with used crocus cloth that has been soaked in lube oil or finest lapping compound (jeweler's rouge) on piece of felt. (3) Tiny pits, rust, especially at plunger ends. Remove by lapping, Fig. 3. (4) Roughness at fuel-helix edges. If nicked, renew, Fig. 2.

These troubles are from dirty fuel, so check all filters. Corroded patches are from water in fuel (centrifuge or settle out), also from sweaty hands handling parts at previous overhaul.

Pitting, etc, can be from heavy-content-sulfur fuel, mixed with water. Resulting acid eats away metal at helix edges. Change to lower-sulfur-content fuel. Ask oil dealer for analyst's report.

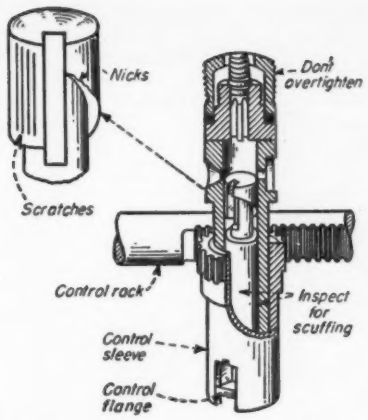
When cleaned and polished, some plunger and barrel assemblies are tested for vacuum by holding finger over open end of barrel (if top isn't closed). Place plunger in barrel and push. Stop pushing. Compressed air should then push plunger out. If no compression, replace pump unit.

If ports in barrel prevent this test, cover ports' top-openings with finger. With plunger in place, invert assembly. With finger removed from top, plunger should start sliding. Cover hole—plunger should stop, Fig. 4. If it keeps sliding, it's badly worn. Smear with lube oil, repeat test. If light lube oil seals plunger enough to stop it falling out, parts are worn but can be used.

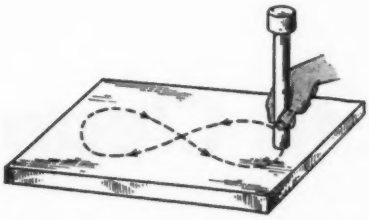
Scoring on one side of plunger (on pump with delivery valve holder attached to pump barrel) usually means that holder was overtightened, barrel distorted. Renew parts.

Discoloration, scratches, tiny pits, call for lapping. Use fine compound (American Bosch No. BM 10007 or Carborundum Co's No. H-400). If lapping on surface plate, make sure plate is flat. Plate that is used for years dishes. Level plate by lapping against another plate, or face off in lathe. Plate-to-plate rub once a month keeps it level.

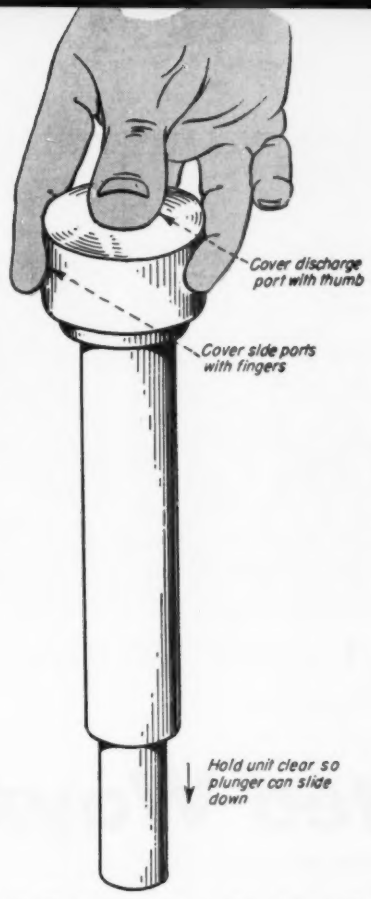
Early or late timing can cause engine to detonate. This means a loss of power. Look for worn pump mechanism, such



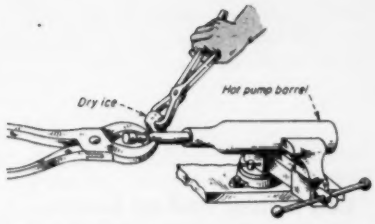
2 Look for nicks at the fuel helix and scuffing on the plunger, inside barrel



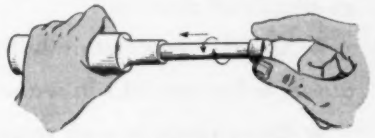
3 Lap plunger ends like this when tiny pits and rust start showing on end



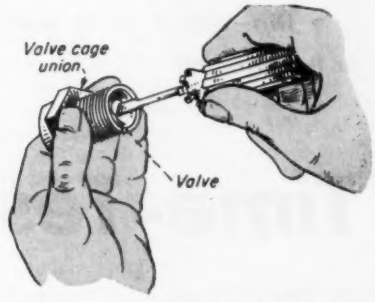
4 Plunger should not slide down with ports covered by fingers like this



5 Free tight plunger with dry ice at one end after barrel is heated in oil



6 Test for sliding fit by pushing on plunger while turning it to and fro



7 Lap in this valve with lapping compound while working with screwdriver

as cams. Also look for lost motion between pump and engine crankshaft from gear-train wear. Clean worn cams with crocus cloth or stone. Measure used cam for wear against pump drawings. Then make allowance to pump's stroke to compensate for loss of travel from cam wear.

Broken fuel-pump plunger-spring causes cylinder to misfire. If spring is weak, engine also misfires. Replace broken and weak springs. Touch nicked enamel on spring coils with enamel to prevent corrosion spreading. Don't dip springs in cleaning solution—it softens enamel, breaks off easier.

If no bench-testing equipment is available for calibrating pump, do this: Clamp pump in vise and connect some kind of drive mechanism to pump coupling or shaft. Connect pump's suction line to gravity fuel tank (can with strong flexible connection). Invert can, punch venting—filling holes. Protect hole with wad of screening, hang above pump.

Bleed all air from pump. With nozzle attached, place control rack in delivery position and start pump by turning wheel's crank at least 100 rpm. When all injectors spray fuel—stop. Place glass cylinder of same size under each injector tip, Fig. 1.

Engine misfiring may be from leaks. Tighten fuel-line union nuts, nozzle bleeder screws, or delivery valve holder. Such leaks are easily found on clean engine. Wipe engine down daily. When tightening won't stop, repair leaks temporarily by chasing crossed threads with file. Then smear with jointing compound.

If misfiring starts, then stops, etc, cause can be plungers, which stick in barrels, breaking free. Run on kerosene lube-oil mixture for short period. Trouble is dirt or gummy deposits, varnishes sticking to sliding surfaces. Check all filter units. You might have to change fuels.

Sticking barrels may not be freed easily from plungers. Soak overnight in carbon tet, acetone or diesel fuel. If this fails, warm barrel in hot oil, place in vise and apply dry ice (with tongs) to plunger, Fig. 5, and pull.

When plunger is out, smear with tallow. Work in and out, turning to left, then right. Continue until plunger slides without pushing, Fig. 6. Pumps are lapped so finely that plunger left on bench in a hot shop (when barrel is in fuel-oil) may not enter barrel because of expansion. Place both in fuel bath if this happens.

Governor troubles are also from sticky plungers. If speed drops when applying load, or engine races when load is removed, or engine "hunts," (speed rises-falls at same engine load), try control rack by hand (if that type). If you can't move by hand, plunger might be stuck in barrel. Free as above. Dirty rack teeth often act as if plunger is sticking.

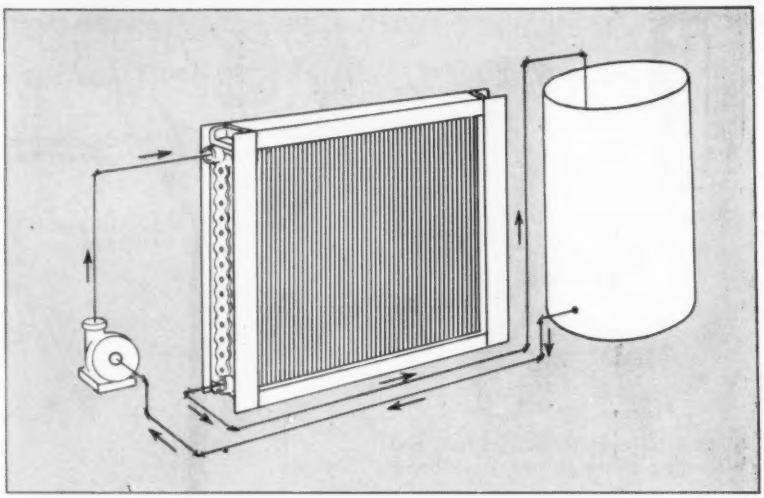
Misfiring can also be from dirty, pitted or worn fuel delivery valves. Delivery valves must slide into their seats under own weight. If they don't slide, dont' push. Clean with mutton tallow.

With all cylinders in place and no drops at nozzle ends, start pumping at 100 rpm for about two minutes. If fuel in each jar is within 5%, pump is fairly well calibrated.

Test two or three times; repeat after every pump adjustment. Try control rack in several positions; if possible, include STOP. Test can also be made with cylinders under injectors while cranking the engine, after first priming system. Test can be made on engines with individual pump near each cylinder.

Coil insides foul up from:

- ***Water scale—brought in as dissolved chemicals***
- ***Slime—has its start with algae, other growths in water***
- ***Oil—sneaks in with some exhaust steams***
- ***Dirt—picked up in wells or from ground***



1 Forced circulation is by far and away the best method of acid-cleaning coil interiors. The above method works very well provided the proper chemicals are used

Time-Tested Ways to Clean

► LAST DECEMBER, pp 134-135, we laid out a series of practical ways to clean off the outside of extended surface coils used in chilled-water or steam and hot-water systems. The inside of these coils needs periodic cleaning, too.

There are four basic substances that collect on and foul internal surfaces of this class of heat-transfer equipment. First and most important is scale that forms when heat precipitates calcium, magnesium, similar salts out of steam, hot water and condensate. Second offender is slime formed by algae and similar plant and bacteriological growths that could be contained in water. Third, but seldom guilty, is oil that shows up most often in coils using exhaust steam. Fourth, and last, is dirty water.

By *dirty* we mean river water, such as you'll find power plants using to cool turbine condensers. That is a special problem all by itself. If a coil is used in this service, it's made up of larger tubes with removable headers, and, in addition, a strainer just in ahead of the coil. The headers can be pulled out without any major disconnecting of piping. The cleaning may be by rodding or a high-pressure air or water stream. But that is not our job.

How the Problem Starts

Scale that settles out of waters upon heating happens most in areas whose natural waters run very hard. Usual problem is just like that of a boiler. Mineral salts build up, clog water circulation, affect heat transfer so coil performance falls way off. Once in a blue moon the salts tie up with hydrogen in the water to form an acid that could and sometimes does attack and corrode the coil metal. This creates a double-edged problem. If you mistake corrosion products for ordinary water scale and try to remove by acid cleaning (see below), you'll run the risk of completely ruining the coil.

Water Treatment Only Preventive

There is no general recommendation in proper water-treatment procedure that would cover all waters used in coil service. Surest answers can come only from reputable water-treatment experts.

Mechanical Scale Removal

Whenever you can remove the coil and get at the inside of the tubes you can take rods and bang away at the scale. This method is somewhat like the old-fashioned garage method of rodding your automobile radiator. But it's never a completely satisfactory method. Usually the scale is too tough. What's more, it requires too much banging, and you can gouge or crimp the tube surface.

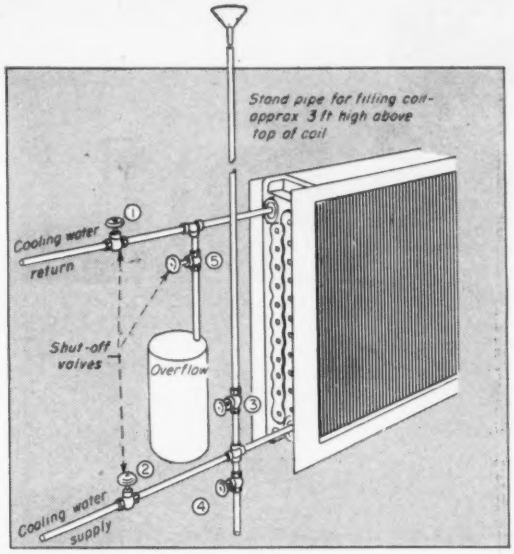
Chemical Surface Cleaning

Here is the best and most thorough way known of cleaning tubes inside. It's got the added advantage of letting you clean the coils in place. But, remember, age and kind of metal in the tube definitely have a bearing on the chemical you use and even how you use it. An old coil can "fall apart" under the action of cleaning agents.

There are countless compounds that attack scale, and unfortunately there are just as many that do the same to metal. And, to make matters worse, they do not all react similarly or even with the same speed. Once again, you need the help of an expert. Often the manufacturer or his representative will advise you on this.

The chemical cleaner or descalant moves fast. So an inhibiting agent (something that opposes the cleaner's natural appetite for metals) must be used to control the chemical. A test kit with special sampling devices helps indicate when the chemical cleaner has completed its job. But here again, if you don't know your way around, you can hire outsiders to acid-clean your heating coils.

Abstracted from Oct and Nov-Dec issues of Trane Co's "Weather Magic."



2 Gravity system of feeding a cleaning-acid solution through a coil often proves too slow for required control, results

Coil Insides

Forced-Circulation Acid Cleaning

Here is one effective way of acid-cleaning your coils.

Block or shut off the supply and return lines of the coil. It pays to provide manual shutoff valves in the original installation when an unfavorable water condition exists. Vent the top opening according to Fig. 1 so gases in the coil can escape. Using a one-inch centrifugal pump and a large wooden barrel or a large crock, connect the discharge side of the pump to the top connection of the coil and attach the bottom connection to the open barrel or crock. Connect the pump's suction side to bottom of barrel or crock. In the barrel, use an acid-action descalant with a concentration of 15 to 20%, Fig. 1.

When the connections are all complete, operate the pump long enough to dissolve the scale. This hookup, Fig. 1, gives a piping setup for coils with both connections at same end. Use opposite-end connections for opposite-end coils.

When full removal is accomplished, turn off the pump, drain the charge from the system, and refill the barrel with fresh water. By starting the pump, flush the coil completely. Then drain the system, disconnect pump and barrel, and reconnect the normal piping.

It is also possible to remove scale from copper tubes with a 25% solution of commercial hydrochloric (muriatic) acid in water. Tubes, of course, should be thoroughly flushed with water after the acid solution is used. Unless the entire internal coil surface is copper, do not use hydrochloric acid.

Neutralizer for Skin Protection

Always have a pail of neutralizing solution available when using any commercial descalants. Should the descalant come in contact with your skin, cover the affected area with the neutralizer quickly.

Use of the above descaling method is limited to heating coils of all descriptions and to hot-water cooling coils. The descaling process must never be used with direct-expansion coils because damage can easily result. As a matter of fact, the refrigerant contains no foreign matter and is in itself an excellent cleaner.

Gravity Acid Cleaning

Even though the forced-circulation method of cleaning coils is generally accepted as the best method, there are times when you need a gravity method of introducing the descalant. Usually, however, the gravity method is too slow for anyone actively engaged in the business of cleaning coils. But, if the gravity method must be employed, here is one that you can use effectively, Fig. 2.

Disconnect coil supply and return lines, close valves 2, 5 and 3. Drain all water from coil, out drain valve 4. Close valves 1, 2 and 4, and open valves 5 and 3. Then introduce into the coil by gravity, Fig. 2, a cold solution of an acid-acting descalant having a concentration of 15 to 20%. Use the same type of acid-action descalant and inhibitor as you would if employing the forced-circulation method.

In instances where heavy deposits have formed in the coil, it may be necessary to apply several charges of the descalant to entirely dissolve all the scale formations. Cleaning should be completed after the last charge of depleted descalant has been drained by flushing with water, and after the coil has been neutralized with any of several alkaline solutions made available by the descalant manufacturers.

To determine when the coil has been thoroughly cleaned and descaled, use the test kit furnished by the cleaner manufacturer, changing the charge as needed.

Slime Removal

To remove slime formed by algae and similar substances, the following procedure works well:

Employ the forced-circulation method above, using in the barrel any of several detergents made by cleaning-compound manufacturers. For best results, dissolve the detergent in 150-F water. If the coil is the condenser of a refrigeration system, use cold or lukewarm water since hot water raises the head pressure in the refrigeration lines to a dangerously high degree. Ater cleaning is completed, check the water side (or tubes) for Freon leaks with a halide leak detector.

Allow the pump enough operating time for the cleaning solution to soften and loosen the slime and soil from all surfaces. Then turn off the pump, drain the dirty solution from the barrel, pump and coil. Refill the barrel with fresh water, and flush the coil by starting the pump. Next, disconnect the system and allow to drain completely.

Unfortunately, in many instances, the forced-circulation method does not provide enough velocity to the solution to dislodge the mud and slime. The only alternative is to remove headers and drive out slime and mud mechanically.

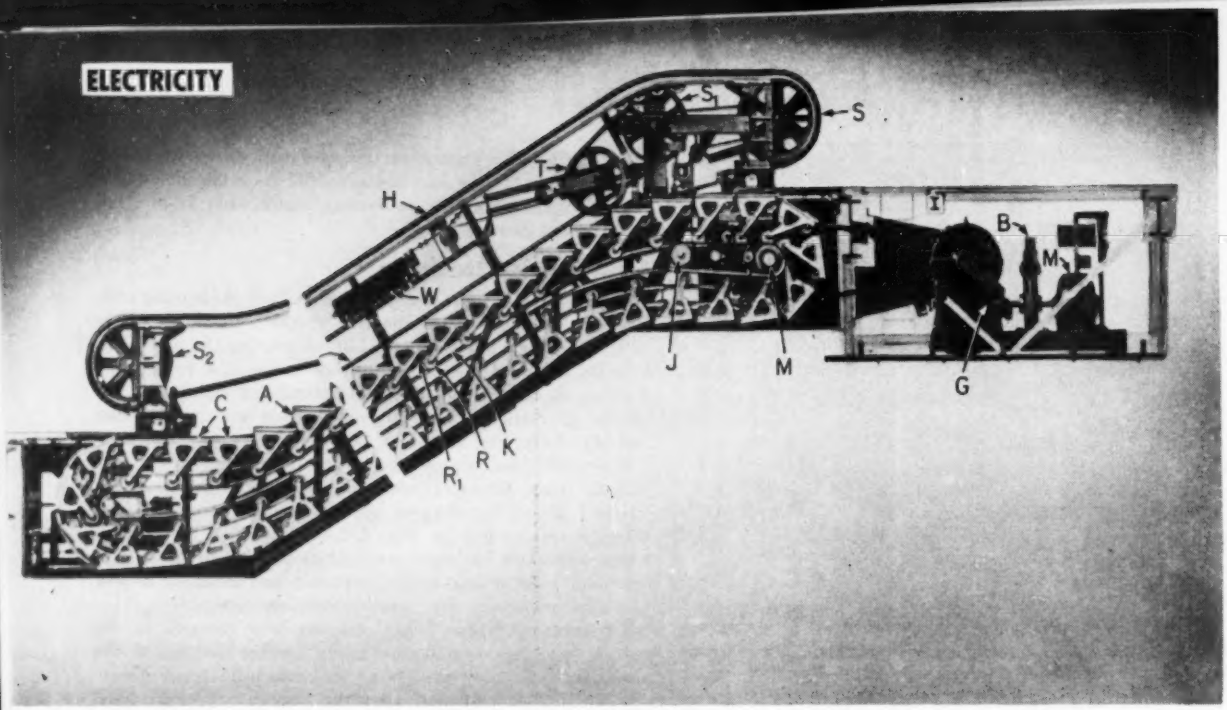
Oil Removal

Occasionally, oil collects in heating coils to such an extent that cleaning is necessary. This occurs most often in coils using exhaust steam. To remove oil from coils, use a detergent or oil-solvent solution and methods similar to the forced-circulation method described above.

Move this solution through the coil for several hours. For best results, the solution in the system should be kept at a temperature of 180 F. After completely removing all the oil, flush the coil with water.

Make Regular Inspection

Regular coil inspection and periodic cleaning, both internally and externally, insure full heat-transfer capacity and long coil life. Cleaning is not difficult if foreign matter is not allowed to collect over long periods.



1 Cross section through a moving stairway, which has three main parts: two rubber-and-fabric traveling handrails; a moving stairs assembled and run in a steel truss; a power unit, usually an electric motor M, and a speed-reducing gear

Get to Know Moving Stairs Before

For greater convenience in all kinds of buildings, use of these stairs grows rapidly. Here's how they operate, are driven, controlled and made the safest riding—all slanted for operating and building engineers

By F A ANNETT, *Contributing Editor*

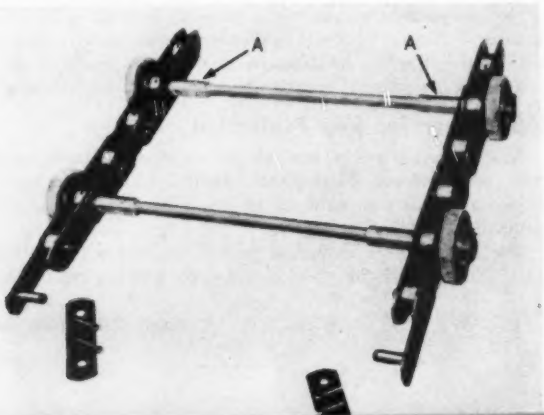
► PEOPLE HAVE BECOME so convenience-conscious that they may object to walking up or down a flight of stairs. For this and other reasons there has developed a need for more and better low-rise vertical transportation in department stores, theaters, railway terminals, subway and elevated stations, factories and other public places. For these services, what may be classed as moving stairways are used in large numbers. They are built under four names: Otis, escalators; Westinghouse, electric stairways; Peelle, motorstair; Haughton, moving stairs. All operate on the same general principle, varying chiefly in design and arrangement of parts.

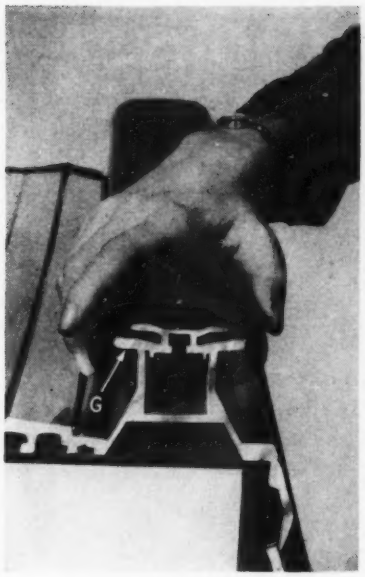
Supporting Truss. These machines are really a highly refined conveyor system. They have three main parts: (1) two traveling handrails (2) a moving stairs (3) a power unit, usually an electric motor and a speed-reducing gear. Fig. 1 shows these parts in their correct relation to each other, supported within a rigid structural-steel truss to hold the stairway in alignment.

Traveling Handrail. In Fig. 1 the traveling handrails *H* are rubber-and-fabric construction, and travel on a

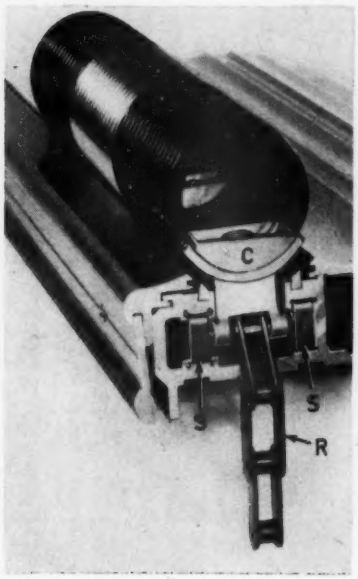
4 Moving-stairway step with metal-cleat tread carried on four ball-bearing wheels, two on step and one on each chain

5 A section of the two step chains that drive the steps by connections from their inside edge to the wheel shaft at *A*





2 Cross section of rubber-and-fabric handrail, formed to run on guide G



3 Metal handrail consists of sections of closely coiled aluminum springs

They Catch Up With You

guide on the balustrade top. At their top ends each passes down over a sheave *S* and back into the balustrade where it passes around a tension sheave *T* and a fixed sheave S_1. From this sheave, travel is down through guides and around a fixed sheave S_2 at lower end of stairway.

Each tension sheave is mounted on a guide frame and connects by a wire rope that passes over two small sheaves to a weight *W*. This weight keeps correct tension in the handrail if its length increases. When this stretch approaches the limit of the tension device, a switch closes to light a lamp in the motor room. If the handrail is not shortened or breaks, a second limit switch opens and stops the stairway.

To drive the handrails a roller chain connects sprockets on the shafts of fixed sheaves *S* and S_1 to a sprocket on a jack shaft *J*. A sprocket on this shaft connects by a chain to a sprocket on the main drive shaft *M*.

Handrail Construction. In Fig. 1, handrails are rubber and duck specially formed to operate on a guide *G*, Fig. 2. Joints are vulcanized to provide a continuous, smooth, rubber surface. The metal guide is shaped to inside of rail to keep friction low and insure cool operation.

Fig. 3 shows part of a metal handrail that consists of sections of closely coiled aluminum springs, shown black and white. Clamps *C* hold the sections together and connect them to a roller chain *R* and to laminated linen and plastic shoes *S* that run between lubricated steel guides. At the top and bottom landings the chain runs on sprockets and is driven from the lower step-chain sprocket shaft.

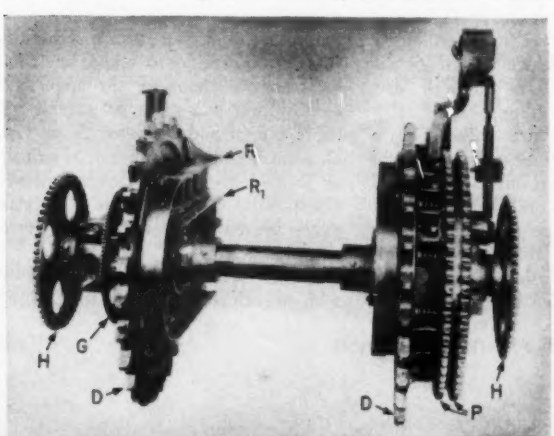
Moving Stairs. Step design is one of the most important features in successful moving-stairway operation. As might be expected step design follows about the same pattern in all makes of moving stairways. One design of step is constructed as in Fig. 4, and is carried on two roller chains, Fig. 5.

Inside edge of each step connects at *A* to the shaft running through the two chains, one on each side of the steps. On their riser side, the steps are supported on a shaft and two wheels. These wheels are at *R*, Fig. 1, and run on a track *K*. Wheels R_1 on the shaft passing through the chain, Fig. 5, support the step and chains on their tracks so both are carried clear of all stationary parts to insure quiet operation.

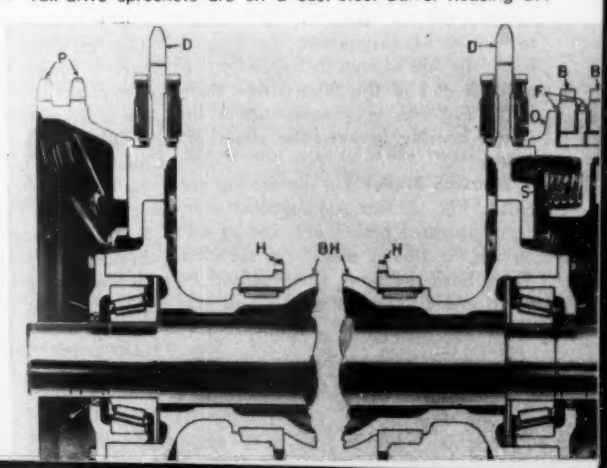
Step-and-Chain Wheels. Large nonmetallic step-and-chain wheels running on antifriction bearings contribute much to quiet operation of modern moving stairway. One wheel design has a tire made of canvas segments on edge bonded to a plastic center. Other wheels have silent duck treads bonded to Micarta centers. Others have rubber tires and still others have a tread made of compressed and impregnated canvas cut on the bias. All wheels are constructed to operate with minimum noise and to act as sound insulation.

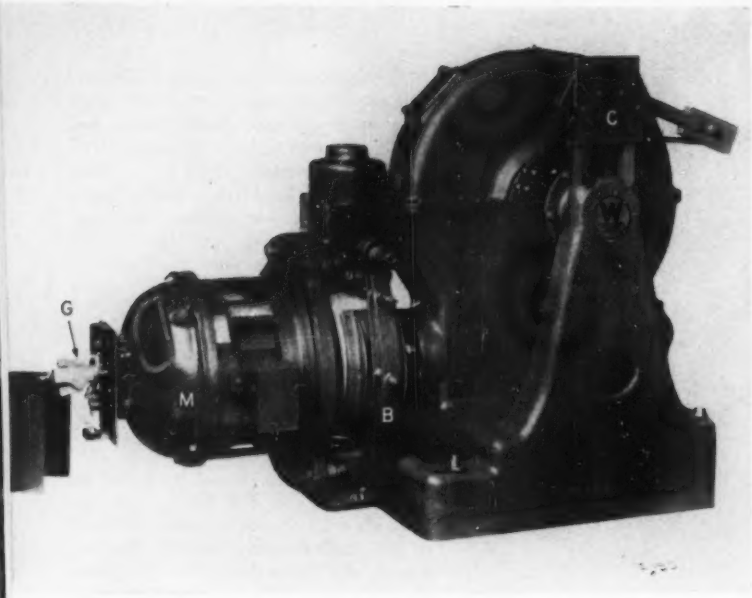
Drive Ends. On all moving stairways the step-chains run on sprockets at their top landings, from which they are driven, Fig. 1. Drive sprockets *D*

6 Drive end of moving stairway with the step-chain, power, handrail and the governor-drive sprockets on drive shaft

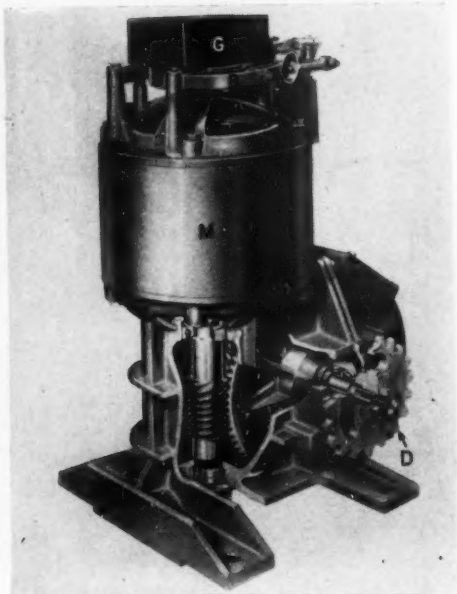


7 On this stairway drive end the step-chain, power and handrail-drive sprockets are on a cast-steel barrel housing *BH*





8 Stairway powers unit, has a squirrel-cage motor *M* and brake *B* supported from lower half of worm-and-gear housing, a rugged one-piece casting



9 Power unit similar to Fig. 8 but of vertical assembly for driving small moving stairways

Moving-Stairway Story Continues With Brakes, Drives, Safety, Capacity and Speed

are shown in Fig. 6 for one type of power end. In this unit the power 2-strand roller chain runs on sprockets *P* and the handrail drive roller chains run on sprockets *H*, one for each rail. Sprocket *G* drives the speed governor. A magnetic brake between sprockets *P* and *D* stops the stairway when power is shut off.

In Fig. 6, sprockets are fixed on the axle and all revolve as a unit, whereas in Fig. 1 the axle is stationary and the step-chain sprockets revolve on it on roller bearings, Fig. 7. Chain-step sprockets *D* are rigidly connected together by a cast-steel spider or barrel housing *BH*, to which they are bolted to prevent misalignment. In Fig. 6, handrails are driven by sprockets *H* at each end of the main drive shaft, but in Fig. 7 these sprockets are on the barrel housing between the step-chain sprockets.

Stairway Brakes. On the driving machine, Fig. 7, two pawl-applied separately-operated brakes are side by side on the right-hand step-chain sprocket. These have two pawl rings, *B* and B_1, faced with friction material *F* and held between plates *O* by tension springs *S*. As long as stairway operates normally, two magnets hold the pawls released from rings *B* and B_1, so the whole brake rotates with the drive-chain sprockets.

When power is cut off by opening a stop or safety switch, one magnet releases its pawl into one of the pawl rings. This stops the ring which slows down the stairway because of the braking action, but the other ring continues to rotate with the drive shaft. A few seconds later the second magnet releases its pawl, which applies the second brake to bring the stairway to a smooth stop. In this system both brakes operate each time the stairway stops, generally at least one a day.

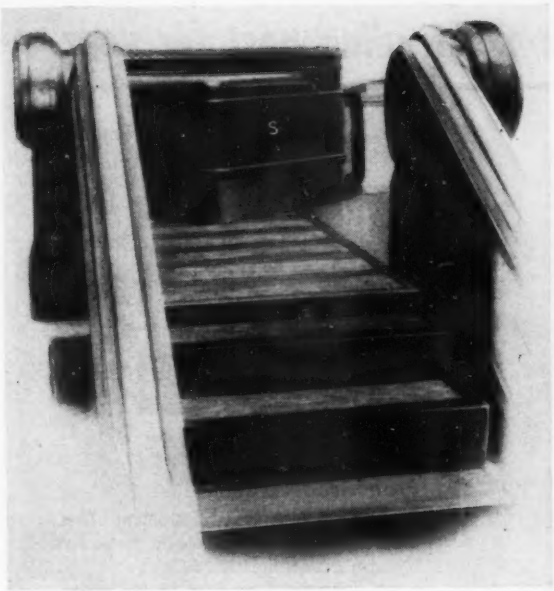
Drives. Moving stairways are driven at constant speed by a power unit that consists of a constant-speed motor and some form of speed reducer. In Fig. 1, the power unit has a single-speed squirrel-cage motor *M*, a service brake *B*, a speed governor *G* and a worm gear, similar to a worm-gear elevator machine. This machine is also built without a service brake. On it the brake on the step-chain sprocket acts for both service and emergency stops.

Other stairways are driven by a closely assembled motor, worm gear and brake of either horizontal or vertical construction, Fig. 8 and 9. Unit in Fig. 8 has a squirrel-cage motor *M*, and a brake *B* supported from the lower half of the worm-gear housing, a rugged one-piece casting to give rigid support to the whole machine. An overspeed and underspeed governor *G* is driven directly from the motor-shaft end. A broken drive-chain switch is at *C*.

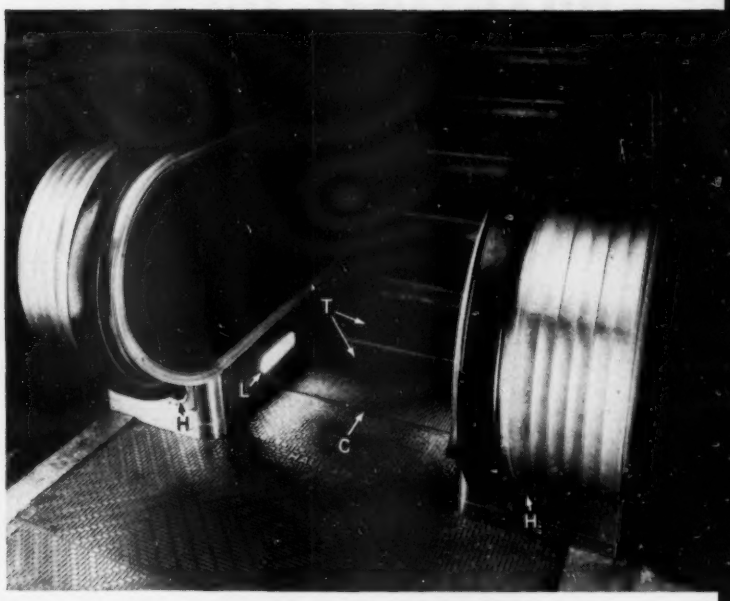
Vertical Drives. Power unit in Fig. 9 is like Fig. 8, but is a vertical assembly for driving smaller stairways. It is designed for installation in top end of truss to save space and reduce building framing. A heavy single-strand roller chain connects the drive sprockets *D* on the machine to that on the step-chain drive shaft. A recent development has a vertical squirrel-cage motor on a worm gear, whose gear shaft connects by helical gears to stairway drive shaft.

Safety. These stairways are the safest means of transportation even though they are subjected to all the pranks that human ingenuity, curiosity and carelessness can devise. They are made safe for even the most careless riders. This is because safety has been designed into every part of the equipment. Beginning with the steps, they have narrow groove treads of wear-resistant aluminum alloy that form a stable platform, comfortable to stand on. Space between the cleats on the steps is so narrow that soft soles or narrow high heels cannot sink between them. Close clearances prevent dragging of galoshes or boots between the treads and skirt risers. Solid step risers and close clearances prevent accidents as step formation changes.

On old type flat-step moving stairways with smooth tread steps, a shunt *S*, Fig.



10 Old-type smooth-tread-step moving stairways required a shunt S at the landings to guide the passengers on and off



11 On modern stairways, comb teeth fit closely between step cleats to form practically smooth surface at the landings

10, was required at the landing to guide passengers on and off the steps. At the loading end of modern stairways the steps come out from under a comb plate, as at *C*, Fig. 11. The comb teeth fit with close clearance between the step-cleat treads to form practically a smooth surface.

Distinct safety features are the ample level spaces formed at the landings by the 2-step tread *T*, nearest the comb plate. When in this level position the two adjacent treads fit so closely together that there is no space or groove in which to snag a heel or catch the point of an umbrella.

Extended Newels. Getting passengers on and off a stairway is one of the most important problems in its safe operation. Semi-circular newels, Fig. 11, at both landings contribute much to solving this problem. In Fig. 11 the newels and balustrade extend for some distance before the steps start to rise. For part of this distance the steps are under the floor and comb plates, then come out and run flat for two tread widths before they start to rise. In this distance, passengers can grasp the moving handrails before reaching the steps, and retain their grip until after they leave them. This assists them to enter and leave the stairs smoothly and without hesitating, which practically eliminates the stumbling hazard on the steps.

Just above the comb plate at each terminal, a light *L* in the sides of the balustrades, Fig. 11, illuminates the landing plate and comb for added safety when getting on and off. Besides, the stairway is well illuminated for its full length. In addition to the features that make it safe to ride on a moving stairway, other safety devices stop it if it is not in good operating condition.

Capacity. For handling large crowds, stairways have many advantages, the first being their large capacity. A single stairway 4-ft wide, operating at 90-ft per min handles up to 8000 passengers per hour, whereas a large low-rise elevator serves only about 500. A stairway handles as many passengers on a 70-ft rise as on 12 ft. Height of rise is a limiting factor in the number of passengers that an elevator can handle.

Moving stairways are not limited to handling large crowds. Frequently they are installed for inter-office service, where one company occupies more than one floor. Moreover, when they connect the ground and second floors of an office building, the second is almost as desirable for renting as the first floor. In department stores they increase sales volume on all off-street floors by making them easily accessible and reducing customer fatigue by eliminating waiting and crowding. These and many other factors have made moving stairways as popular as elevators for low- and medium-rise service in many types of buildings.

Stairways in Series. Even though moving stairways are limited, in the height of a single rise for which they can be built, to about 80 ft, they can be operated in series so that they will serve several floors.

This practice is often used in large department stores. This type of operation requires a transfer at each floor. This is not a serious objection in a store, because a large part of the traffic is from floor to floor.

Stairways can be operated (1) ascending (2) descending (3) or in both directions. To accommodate traffic peaks they may ascend for part of the day, and descend for the rest of the time.

Higher Rises. To adapt moving stairways to higher buildings a system combining express and local stairways was proposed by G B Gusrae in April 1952, *Architectural Record*. In a 10-story building the express units would serve 1st, 4th, 7th and 10th floors.

Thus a passenger could go from the 1st floor to the 10th floor and transfer only twice, compared to eight times on the locals. Travel time on the express is 2 minutes, 31 seconds, on the local 3 minutes, 19 seconds. To go from the 1st to the 6th floor, a passenger would express to 4th, take local to 6th, requiring two transfers and 2 minutes, 47 seconds to make the trip.

Mr. Gusrae arrived at the conclusion in his article that besides lower daily operating cost with moving stairways, they do not require penthouses, pits, complicated controls. They also need less floor space than elevators of comparable capacity, and they cost less.

PRACTICAL IDEAS...*here's the trading post for your*

Anchor Your Switch Boxes Well

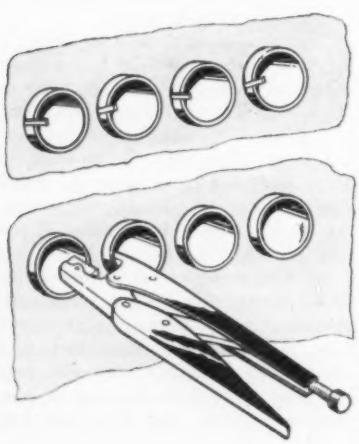
WE INSTALL a lot of boxes, such as this fused disconnect switch box. Whether placing on hollow tile as shown or any other wall, anchor box, so it stays put.

This one has angle iron under box to support box's weight. The ⅜-in. anchor bolts holding it are fastened into tile with cement. This strip of angle iron takes load off box. We hold box fast with anchor bolts fastened in wall.

Box doesn't depend on conduit connections here. And there is no danger that throwing and pulling large switch will loosen box, only to cause electrical ground from cables rubbing during movement.

Regardless of price, there's no substitute for good installation. It heads off maintenance bills and outage.

MIKE BRANNIGAN *Kansas City, Mo.*

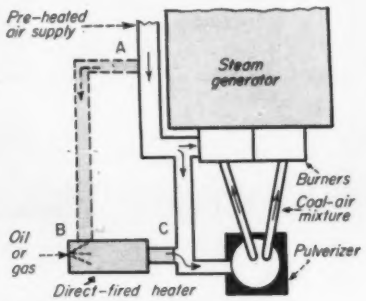


These Pliers Hold Condenser Tubes

EVERY TIME we retubed a condenser or boiler, one problem came up. As we use power expanders to expand tubes into sheet, we pinned opposite end of tube with nails or similar wedges, top sketch. If we didn't wedge tubes, they turned with expander, pulled out of sheet. Nails and wedges often slipped out. If not, they usually bent condenser tubes while they were hammered between tube sheet and tube.

We bought several vise-grip pliers, and clamp two tubes at once, sketch. No trouble with tubes slipping, bending.

J E LACEY *New York, N. Y.*



Separately Fired Air Heater Dries Coal

PULVERIZED-FUEL-FIRED equipment often takes a severe reduction in capacity because coal's moisture is high.

All pulverizers need preheated air to dry coal for optimum output. Hotter air is needed as coal's moisture increases because you can only force so much air through pulverizer. When moisture is too high for available air temperature, coal output must be reduced to maintain steady coal flow at proper pulverization fineness.

Because of widespread deterioration in coal quality during past ten years, many steam generators are limited by mill capacity to 60-80% of their rated steam flow. Total deficiency is often from increased ash content and lower grindability.

But all pulverizer users should learn effect on capacity of increased air temperature from pulverizer manufacturer. Here are three ways to get higher air temperatures: (1) Add surface to existing air heater. (2) Install separate air heater for mill air only, in region of convection passes served by hotter gas. (3) Install separately fired air heater for mill air only. This air heater should be fired by oil or gas and used only during periods of high moisture coal.

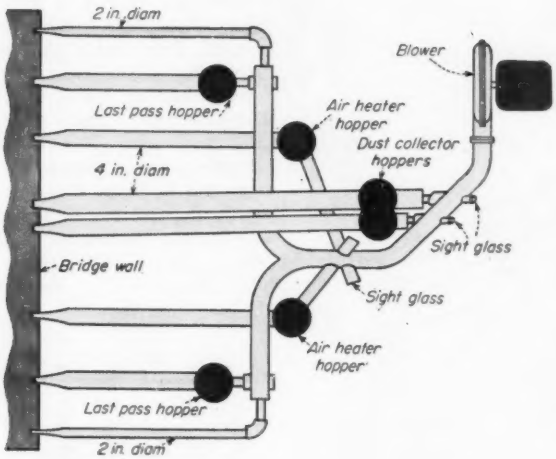
Methods 1 and 2 are not usually practicable in existing installation because of space, cost or basic heat-transfer conditions. Method 3 is usually possible and economically sound.

Sketch shows schematic arrangement of equipment for separate direct-fired air heater. You can save on initial cost by omitting duct from A to B. In this case, take room air directly through direct-fired heater and mix with preheated air at mill inlet, which is usually under slight suction. This is same as bypassing air around existing air heater and, therefore, lowers boiler efficiency slightly. But coal is thoroughly dried.

F J CULY *College Point, N. Y.*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*



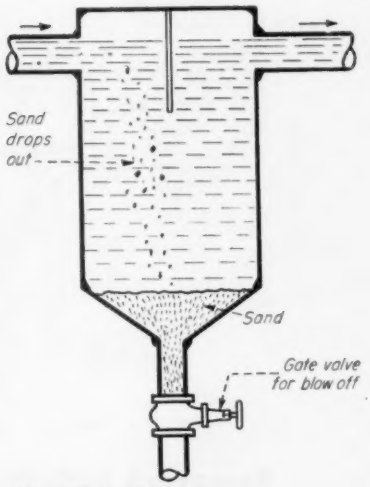
Cinder-Return System Solves Flyash Trouble

OUR BOILER PLANT has two Stirling boilers rated at 75,000 lb per hr, at 150-psig saturated steam. Boilers are fired by spreader stokers on chain grates, burning southern Illinois coal. Cinders and flyash are separated from flue gases at last pass, air heater, and dust collector at induced-draft fan. Then they are returned to furnace through bridgewall about one foot above grate line.

In past, fire smoked at loads about 65,000 lb per hr and flyash piled up alongside walls so it interfered with fire. Sketch shows how cinder return system was changed to eliminate flyash trouble completely. We now have an even distribution of cinders across grate, with loads of near 90,000 lb per hr without smoking, which solved our problem.

Notice that all return lines carrying cinders and flyash make straight runs from hoppers through bridgewall. Before change, return lines from hoppers under last pass were bent to enter at corners of furnace. They blew diagonally across fire. A 2-in. pipe was added on each side of furnace to blow air along side walls to free them of flyash; also, for more overfire air and turbulence for fire in those areas. Size of air lines to hoppers of last pass and air heater were reduced to dimensions shown. All work was done by boiler house personnel. Job has proven one of best changes we made. Blower is rated at 875 cfm, 12-in. water; needs 13 hp.

W M MONTGOMERY
Des Plaines, Ill.



Strainer Saves Reciprocating Pumps

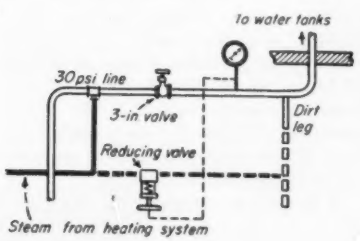
SAND CUT our reciprocating boiler feed-pump packing and scored liners. It clogged boiler-feedwater regulating-valve strainers with packing. It also caused trouble in other reciprocating pumps. To remedy, we installed a sand separator as shown.

Plant and boiler water is taken from river and passed through a pressure sand-filter. Before we had strainer, filter picked up at times minute quantities of fine sand that got into system.

Since separator was installed, no trouble with pump packing and liners.

This strainer can be designed with baffle plate or plates arranged so they will handle various problems.

M EVANS *Chicago, Ill.*

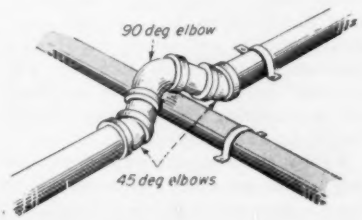


Regulator Keeps Tank From Freezing

WE HAVE two outside water-storage tanks, one is a tower and one a surface tank. In winter when water's temperature drops to 38 F, we cracked a 3-in. valve on 30-psi steam line. That kept steam 15 psi on coils in water tanks. This worked OK while water usage was steady, also when outside temperature remained constant. But when these two changed, steam pressure on coils would either build up or drop down.

This condition was solved by installing a 1½-in. tee, shutoff valve and a medium pressure-reducing valve on branch, run off 30-psi line. We piped steam line into dirt leg as shown. with dotted lines. Needed pressure was set on red. Fluctuation of water supply or outside temperature does not affect steam pressure on coils to water tank. Now 3-in. valve is used only as bypass. Change takes guess out of regulating.

A ROCKLIN *Chicago, Ill.*



Pipe Crossing

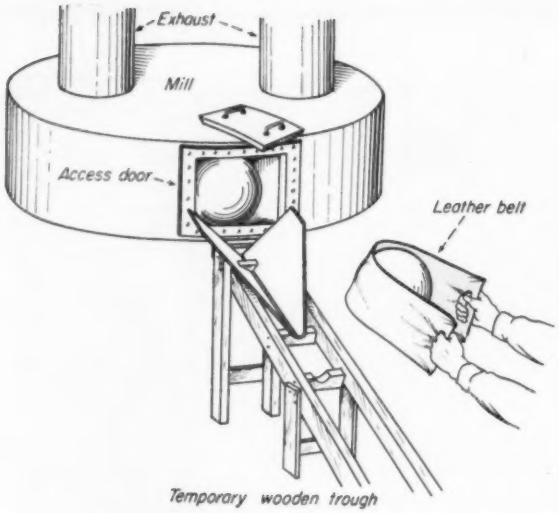
WHERE IT IS NECESSARY for one pipe to cross another on a flat surface, each can be attached flat on the surface. Use one 90-deg and two 45-deg elbows in one of the lines, as shown.

T TRAIL *Catonsville, Md.*

(*Continued on page* 128)

More PRACTICAL IDEAS

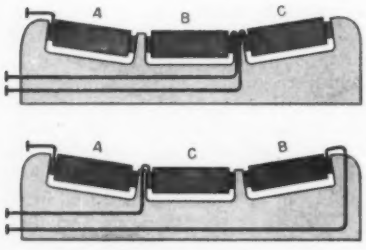
Begins on page 126



Removing Balls From Pulverizer Mill

BECAUSE REMOVAL DOOR on ball mill is not very large, weight of balls and close quarters make removing a tough job. We cut a piece of common belting 30 in. long by 8 in. wide with two slots for hand holes, as shown. Now balls are pulled out very easily to the trough.

C W BENTLEY *Clinton, Iowa*



Longer Life for Conveyor Rollers

OUTER BEARING on roller *C* in top sketch runs dry because it is farthest from grease supply and grease must push upwards to completely lubricate the bearing. Trouble was grease squeezed out inner bearing without going through bearing to do a complete job.

We thought of turning roller *C* around end for end, but could not because shaft has a right-hand thread on one end and a left-hand thread on the other. But repairs were costly. It took about ten manhours to repair one set of bearings whenever it ran dry and scored.

By switching rollers *C* and *B* as shown in lower sketch, both end bearings are greased from upper end. That also meant switching oil lines around as shown so grease reaches trouble spots first. We also considered that grease naturally works down to inner bearing after it is heated from work.

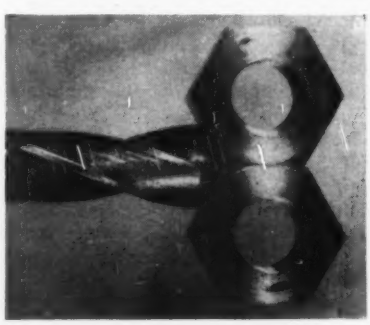
By making these changes, our maintenance labor is very much less and our roller bearings last a long time.

LEO COLLEN *Clinton, Iowa*

Gage for Grinding Drills

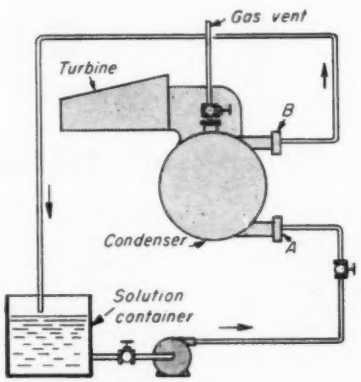
BEST DRILL-POINT ANGLE for twist drills is 118 degrees. Closer that cutting line approaches this angle, the better drill will cut. But few maintenance mechanics bother to use a drill gage. They usually estimate the angle by looking at it. As a result, their drills absorb a lot more power and energy to drive through the work than they should.

If you do have a drill gage, maintenance men usually use it. One handy form of gage that can be used for most maintenance drilling is two hex nuts shown. Hold nuts so two flats are in contact. Then angle of 120 deg is formed for gaging the drill point.



Angle of 120 deg is usually closer than guessing. As photo shows, guessed angle here comes close to ideal as seen by space between gage and drill point. Gage can be made a permanent addition to the tool box of a mechanic by soft-soldering the two flats together, thus making gage easier to use.

C T BOWER *London, Eng.*



Acid-Cleaning Heat Exchangers

IN ACID-CLEANING heat exchangers, some surface parts are cleaned better than others. This is from concentration at inlet of heat exchanger that is higher (even though ever so slightly higher) than concentration at outlet. Then, too, mechanical conditions of flow, such as eddy current and gas pockets cause variations in cleaning procedure.

To obtain uniform cleaning job, reverse the flow. Change piping (after passing acid for about half of total time) from positions shown in sketch. Make pump discharge go to *B* and make condenser outlet at *A*. When pumping acid into *B*, have a fairly high vent (4 or 5 ft) so gas is removed without losing acid solution.

A RODRIGUEZ *Mexico City, Mexico*

Use No. 3 Lead

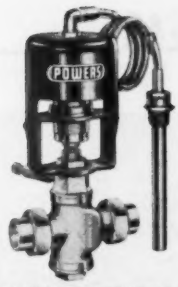
No. 3 PENCILS don't make lead smears in filling out production and log sheets. This harder lead is also better since it doesn't break like the soft ones.

L FITZPATRICK *Jefferson City, Mo.*

(*Continued on page* 130)

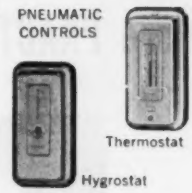
MASTROL SYSTEM for Forced Hot Water Heating

PNEUMATIC CONTROLS



No. 11 Self-Operating Regulators

PNEUMATIC CONTROLS

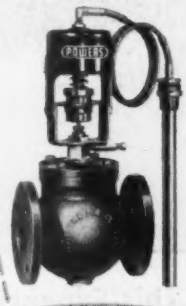


3-Way FLOWRITE Valve

Pneumatic Switches

FLOWRITE Diaphragm Valve

ACCRITEM REGULATOR
Compressed Air or Water Operated

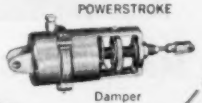


Radiator Valves

Packless Valves Available

AIRSTREAM Thermostat

POWERSTROKE



Damper Motor

FLOWRITE Valve

METAFLOW Valve
Available Packless

POWERS

TEMPERATURE and HUMIDITY CONTROL

For Heating and Air Conditioning Systems Industrial Processes

Water Heaters • Heat Exchangers Jacket Water Cooling

All Types of Baths Hospital Hydrotherapy

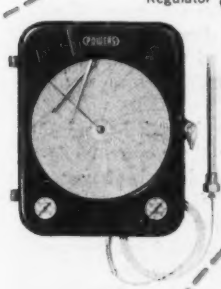
Most of your control problems can be solved successfully with the aid of a POWERS engineer and the proper application of some of our modern products. Why not profit from our 60 years of experience? There's no obligation. Phone or write our nearest office.

(GN)

Series 100 Pneumatic Indicating Regulator

Pneumatic

Right: Static Pressure Regulator



Left: Series 100 Recording Regulator

Self-Operating

Thermostatic Water Mixers

THE POWERS REGULATOR CO.

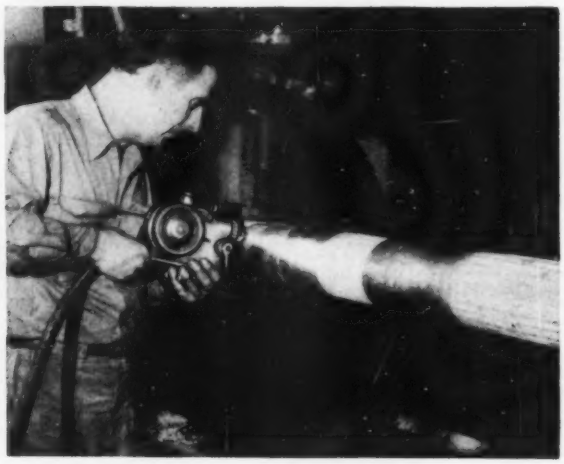
Established 1891 • Offices in Over 50 Cities • See Your Phone Book

FACTORY AND GENERAL OFFICE — SKOKIE, ILL.

CHICAGO 13, ILLINOIS • 3819 N. Ashland Avenue
NEW YORK 17, NEW YORK • 231 East 46th Street
LOS ANGELES 5, CALIF. • 1808 West 8th Street
TORONTO, ONTARIO • 195 Spadina Avenue
MEXICO, D. F. • Apartado 63 Bis.

More PRACTICAL IDEAS

Begins on page 126



Metalizing Saves This Expensive Shaft

THIS SOLID MONEL propeller shaft, 14 ft long by 6 in. dia., is being sprayed with stainless steel. It is used on a tugboat around New York harbor that earns rental of $60 an hour. Shaft was badly worn at stern packing, causing serious leakage into tug.

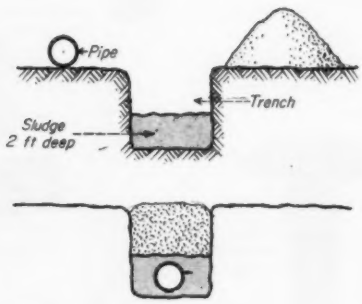
With nickel in critical supply, two to three months was needed for delivery of a new monel shaft stock. With additional week to machine it, cost was estimated from $1200 to $1400.

Forged steel stock could be used and delivered in only two to three weeks at about $1000. But experience showed life of steel in this service is only about one-quarter that of shafting of monel.

Metalized stainless on monel for service through packing gland shaft lasts longer because of improved lubricating characteristics of sprayed metal.

Here's how job was done. Worn portion of shaft at stern packing area was turned down in lathe to 6⅛-in. dia, then prepared with a special roughening tool. Next, about 8 lb of stainless steel was sprayed to bring diameter to 6 5/16 in. Shaft was then turned to required 6¼-in. dia. Total time for entire operation was eight hours.

JOHN MCREADY
Long Island City, N. Y.



Sludge Protects Underground Pipe

HERE'S HOW we cut down high cost of anti-corrosion protection for piping and still had long pipeline life. We imbedded bare pipe in carbide sludge from adjacent acetylene plant. After pipe trench was dug, we dumped sludge into trench to 2-ft depth, depending on pipe size, then back filled, sketch.

Carbide sludge refuse is 50% sludge and 50% water by weight, after a period of settling.

Sludge pond where this highly alkaline material is dug shows this analysis even after settling for 25 years. Main ingredient is calcium hydroxide, which neutralizes acid earth and keeps out oxygen.

Some of our underground lines have been in 15 years and are in excellent condition, with little or no evidence of pitting. Sludge costs are nominal; sometimes costs are for haulage only.

J D CONSTANCE
Cliffside Park, N. J.

Cabinet Stores Spare Parts

MAINTENANCE MEN can't anticipate parts needed for every job. When arriving at top floor on an emergency call, mechanic must often return to basement for a fuse, pipe repair clamp, light bulb, etc. Acting on suggestion offered by one of our men, we installed cabinets on each floor landing, sketch. Cabinet sets about 15 in. deep into corner, and contains supply of every size electrical item needed on that floor, also other supplies.

As space is not used in normal stair traffic, there's no floor-space loss.

L KASPER *Philadelphia, Pa.*

An Exhaust-Fan Puzzle

WOODWORKING SHOP had an exhaust system served by four large fans. Fans carried away sawdust and shavings from various machines. One fan was belt driven from a 60-hp motor and was fully loaded. One morning it was out of order at starting time.

On checking motor, maintenance crew found it OK, but motor seemed heavily overloaded. It barely turned fan over, let alone run at 600 rpm. When checking fan itself, lower half seemed "dead" when sounded with a hammer.

If unit didn't run, 100 men would have to go home.

We drilled a hole through bottom of fan casing, because there were no inspection plates. A barrel of water drained out and the unit started as usual. Cause was that old steam line was leaking in abandoned cyclone on roof. We removed this line.

W B MCDERMID *Norwood, Ohio*

PLASTIC goes to press FASTER

"The use of Yarway Impulse Steam Traps on our platen presses has speeded up our production rates to such an extent that it almost appears we have developed an entirely new process."

That's the Chief Engineer of a large Michigan plastics fabricating plant speaking . . . and he backs up his words by standardizing on Yarways throughout the plant three months after making a trial installation.

You may be surprised at how much faster your product can be produced when Yarways trap your steam equipment. Yarway Impulse traps are designed with production in mind. They insure sending maximum B.T.U.'s at top temperature into your process or product. They get equipment hotter, *sooner* . . . and keep it hot!

Yarway Impulse traps are small, easily installed, good for all pressures, made of stainless steel, require minimum maintenance, cost little.

Try Yarway Impulse traps yourself. Stocked and *sold* by 216 Industrial Distributors. For steam trap advice, call your nearby Yarway trap engineer.

the steam trap designed with more production in mind

"Please Pass The Condensate" is a new 20-minute, color film on steam trapping for more production. Write now to arrange a plant or group showing.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

PLANT PROBLEMS... *put your know-how to work*

REGULAR INSPECTION of motor starters cuts maintenance cost and prevents sudden failure. Modern control units are designed for speedy inspection, parts renewal

KEEP HOISTS in topnotch shape at all times to cut production, handling costs

Why Does This Motor Reverse?

HERE ARE THE FACTS: Our overhead crane has a polyphase squirrel-cage motor for its drive. Recently it has given us trouble we can't cure without help of some kind.

Motor pulls its load until stalled. Then it occasionally reverses and lowers load or pays off cable from drum until operator releases friction clutch. It runs backwards until line switch is opened.

When switch is closed again, motor runs right at full speed. It may do this for several days before it again stalls.

Current supply is 220 v, 60 cps. Motor is connected delta with the two coils in each leg in parallel. Name-plate rating is 10 hp, 60 cps, 220/440 v, 28/14 amp, 1680 rpm, 55-deg rise, 10-min time rating

What causes this reversal? How can we cure it in our plant? What are good tests to make?—*GS, Jan Power*

Here Are the Answers

PHOTOS ABOVE show how easy it is to care for well-designed and properly installed electrical equipment for cranes and hoists. Be sure your equipment is in good shape at all times if you want the best results. Then there is little chance of sudden shutdowns or failures.

We always get the help of our equipment manufacturers before setting up a maintenance program. With their help it is easier to set up a foolproof program that gives certain results, prevents unscheduled outages.

K L Bassett *New York, N. Y.*

TURN TO page 134 for your two new problems from *Power* readers on (1) preventing leaks in valve glands and around stem and . . .

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

MOTOR RUNS single phase when it stalls and reverses. On single phase, power output drops and motor stalls. Weight of load causes motor to rotate in opposite direction. Once motor starts in any direction it continues to run in that direction until line switch is opened.

Three-phase motors run single phase if a fuse is blown, if there's an open phase in winding, poor contacts in motor controller, loose connections in the wiring, or any of a number of faults.

If hoisting cable is too short, it may wind on the drum in a direction opposite to that in which it unwinds. This would have the same effect on the hoist as a motor that reverses its direction of rotation at intervals.

G H HILL *Sunbury, Pa.*

MOTOR LEAD that opens during crane use produces single-phase operation, cutting power about 58%. That's when stalling and reversal occur. Check all motor leads and connections for signs of an open circuit.

CRANE LOAD is greater than motor was designed for. Reduce load to stop stalls and reversal of the crane motor.

M PLAVEHAN *Lodi, N. J.*

HUNT FOR TROUBLE in motor-control devices. No motor-winding fault could create reverse rotation and correct itself to normal.

Solenoid contactors may function poorly on heavy overloads. Check reversing-switch contactor and each solenoid. See that coil resistance, hot and cold, and air gap or armature position are right. Simple open circuit may allow motor to drift but will not cause reversal.

Make a full 3-wire diagram of existing control connections. Don't copy this from drawings or sketches. Instead, show connections as they actually exist for the crane motor, and for other motors and controls on load side of the main line switch. Compare this diagram with the standard one for the crane motor and control. Differences show up immediately.

Test insulation resistance of motor

(*Continued on page* 136)

How Can We Convert Our Heating Plant?

HERE ARE THE FACTS: Our heating plant runs at 125 psi. For several reasons we have to convert the boilers to run at 15 psi.

Boilers are hrt units with a rating of about 5000 lb per hr. Each has two 3½-in. safety valves, one 6-in. nonreturn valve and one underfeed stoker.

We have no flowmeters, draft gages or CO_2 meters to show if boilers run at full capacity. About two-thirds of our heating load is on gravity returns, the rest on vacuum returns. Heating-steam pressure is 5 psi.

What changes are needed to safety and nonreturn valves to convert to 15 psi? Will a vacuum system be needed for returns that are now gravity? How can we find boiler output?—*LW, Jan Power*

Here Are the Answers

SAFETY VALVE on each boiler will probably have to be changed to handle the higher specific volume steam at 15 psi. But if present valves are larger than needed for 125-psi service, there's a chance they may be suitable for steam at 15 psi.

Check with valve manufacturer to see what new capacity will be. It may decrease sharply. For instance, one valve with a capacity of 2200 lb per hr at 125 psi has a capacity of only 460 lb per hr at 15 psi.

Use a Hartford steam loop to prevent boiler from losing water while on heating load. Use gate valves in supply and return lines for boiler isolation during shutdown and repairs. No vacuum system is needed for the existing gravity returns.

Install a flowmeter to measure boiler output at all heating loads. Use indicator, recorder or integrator type, depending on what type records you wish to keep.

A J BREUGELMANS *New York, N. Y.*

CONVERSION isn't difficult or expensive. First step is to check your present safety-valve capacity at the reduced pressure. See that new valves, if needed, are chosen using the proper code for your area. Be certain to have your insurance company check valve size before you purchase replacements for existing ones.

Set pressure regulators to hold 4 to 6 psi in heating system. Run system for several days and check heat output. If buildings are cold, raise setting to increase heating-system header's pressure.

Don't switch to a vacuum system unless studies show you'll save fuel. If the present system performs well, there is no need to switch to vacuum. Later *LW* may decide to switch to a vacuum or hot-water system.

Use flowmeters or condensate meters to measure boiler load. Replace the nonreturn valves with outside-screw-and-yoke rising-spindle type stop valves. Use the same type of valve on the return line.

My best advice to *LW* is to work closely with his boiler inspector and a good heating engineer before going ahead with this job.

A R ECKERT *Mt. Vernon, Ill.*

RUN BOILERS at 125 psi and reduce pressure to 15 and 5 psi with regulating valves. Boiler runs more efficiently at its designed pressure than at the reduced pressure. If *LW* does reduce operating pressure, he should keep an eye on scale formation at the new pressure. Change in water circulation conditions can produce different scale forms in shell and on tubes.

W H MILLER *Lancaster, Pa.*

CONSULT ASME CODE for heating boilers before doing any work on this job.

(*Continued on page* 134)

. . . (2) locating valves that have been buried underground for a number of years. This is another chance to try your engineering ingenuity

More PLANT PROBLEMS

Begins on page 132

Code requires spring-loaded-type safety valve, sealed to open at a pressure not greater than 15 psi. Determine size from grate area, as in the code.

Don't replace nonreturn valves because they will operate on any pressure. They'll serve both as check and as stop valves.

Install new steam gages calibrated at twice the pressure, or to 30 psi. Remove all steam-reducing valves from the lines. If steam piping run is long, it may be necessary to increase pipe size to prevent excessive pressure drop.

There is no need to revamp the heating system because it now operates at 5 psi. Allow condensate from vacuum and gravity returns to flow to a receiver before pumping it to the boiler. Use a float-operated motor-driven low-pressure centrifugal pump for this service. Feed makeup from city-water system to condensate receiver, if local laws do not prohibit such a hookup.

Simplest way to find boiler output is to install water meters and thermometers on condensate return to each boiler. Lastly, if you're using a steam whistle, it may be necessary to take it off the steam line and then to fit it to the compressed-air system.

GEORGE HILL *Sunbury, Pa.*

SOME SAFETY VALVES are suitable for conversion to low-pressure service. Before buying new valves, check with manufacturer to see if yours are. Be sure valves you choose have enough capacity to relieve properly under the new firing rate. Nonreturn valves do not need any changes.

Remove present reducing valves that cut steam pressure from 125 to 5 psi. *LW's* existing piping appears large enough to handle the low-pressure steam. It may be advisable to change some of the gravity returns to vacuum to assure prompt return of condensate from system.

Determine boiler output by weighing coal fed to stoker hopper. With this and the heating value of the coal known it is easy to find output if you use the equation given in the ASME Boiler Code.

H A KAISER *Glendale, N. Y.*

BOILER INSURANCE companies and state codes require strict adherence to their rules. Check your insurance company and code before getting to work.

Present safety valves can probably be fitted with new springs to handle about 2000 lb of the required relieving capacity. Remainder of capacity can be assigned to two new valves on a Y.

Find maximum stable steaming rate by testing boiler at lowest suitable pressure for heating system after the new safety valves are installed. Test may show there is a capacity limit or that piping alterations are needed.

LW can find boiler output by measuring system returns, weighing coal fed to boiler, and computing evaporation or computing steam output as 3 lb per hr per sq ft of heating surface.

C W BELL, SR *Hazleton, Pa.*

HEATING SYSTEM will require same Btu output after pressure is reduced, as before. About 5150-lb-per-hr steam is required after pressure is reduced in the boiler. Pressure drop through the 6-in. boiler lead is about 0.3 psi per 100 ft of pipe. *LW* may find he must increase line size to reduce pressure loss.

A H MOULTON *Pittsfield, Mass.*

AN EXPENSIVE JOB is in store for *LW* if he reduces his boilers to low pressure. Safety valves must be overhauled, fitted with new springs and reset. Check nonreturn valves to see there is enough pressure to lift the disks.

I think a vacuum-return system is better than gravity because it eliminates sluggish lines and permits use of smaller return lines. Install a steam flowmeter and a draft gage to make operation easier and more dependable.

A A HUNNEWINKEL *Woodstock, Ill.*

CHANGE FIRING RATE of stoker when boiler pressure is reduced. This prevents unnecessary safety-valve popping.

LW should consider installing a 3-element combustion-control system to regulate feedwater, fuel and air to maintain proper firing rates at various loads. Cost of a simple system like this is more than offset by fuel and labor savings.

Safety-valve setting will have to be changed. *LW* may be able to use the same valve bodies if he changes the orifice size and spring. See safety-valve manufacturer for recommendations on orifice and spring size.

Check nonreturn valves. Force on underside of disk may not be enough to lift it. Valve manufacturer will recommend any needed adjustments. Don't make any changes without first checking with the ASME Boiler Code, state and local laws.

If combined pressure drop of steam and condensate systems exceeds the available boiler pressure, a vacuum-return system is needed. Be sure pump is specially designed for this system.

H B WAYNE *Brooklyn, N. Y.*

(*Continued on page* 136)

YOUR NEW PROBLEMS

1 How Can We Stop These Valve Leaks?

Valves in lines to our two low-pressure feedwater heaters leak when load is low. These valves are in vent, steam and drain lines for the heaters.

Plant is rated at 400,000 kw. Air appears to leak through valve packing at the gland. There is some leakage at valve stem.

New packing doesn't help much. Air that enters through valves shows up in our condensers, hurts plant performance.

Since most of these valves are usually kept fully open or fully closed, we've been wondering if reversing them in the line would help. Flow would then act against top of disk of these globe valves instead of bottom, as it now does. Condensate on top of disk would help seal it while the valve is closed. Or is there a better way to stop leakage?—*GD*

2 How Can We Find Underground Valves?

Our hospital has over 100 buildings on 1600 acres of land. Water-supply pipes run underground to all parts of the hospital. System is quite complex.

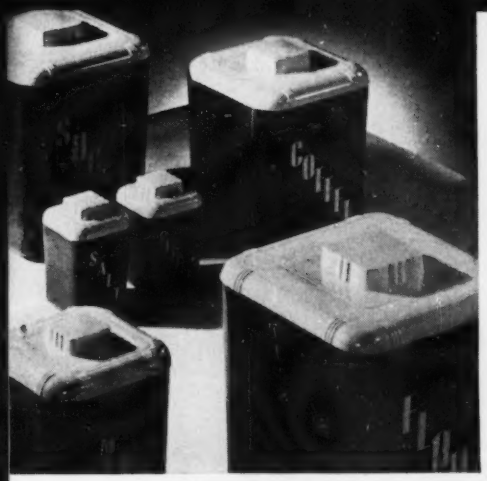
Several times we have had to locate underground shutoff valves in a hurry. Because we have no positive system for finding the valves we've wasted water, isolated the wrong buildings, and had many delays.

Problem is further complicated by system changes not marked on our blueprints, personnel turnover and poor indication on our drawings of the is also some leakage at valve

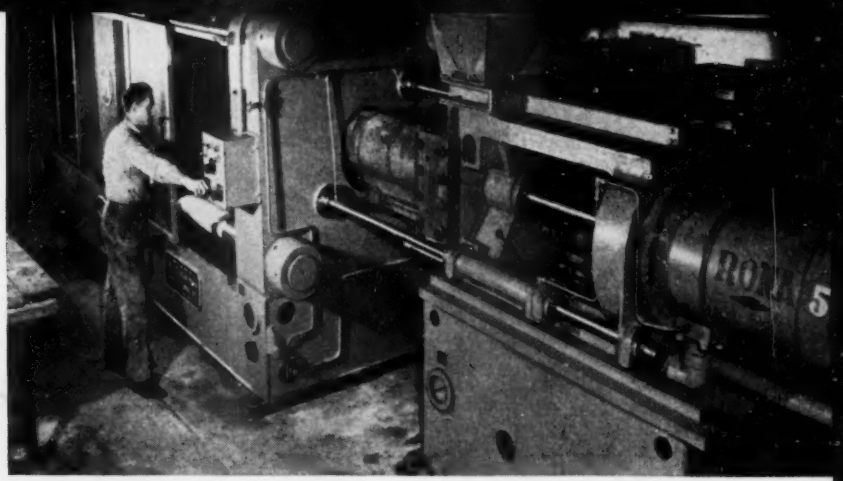
What I'd like to do is straighten out this mess without having to dig up every pipe and valve we have. Then I'd like to place unobtrusive markers for the valves that will not interfere with lawn mowing.

How do *Power* readers running large plants mark their valves? What system is best for quickly showing which valves should be closed to isolate one building or a group?—*BL*

Will you help readers who sent us problems? Extra pay for photos or sketches.



NO MORE PROBLEMS. The production of plastic household items by Rona Plastic Corporation was slowed down by an inadequate hydraulic oil. A switch to Sunvis 999, over a year ago, restored it to normal.



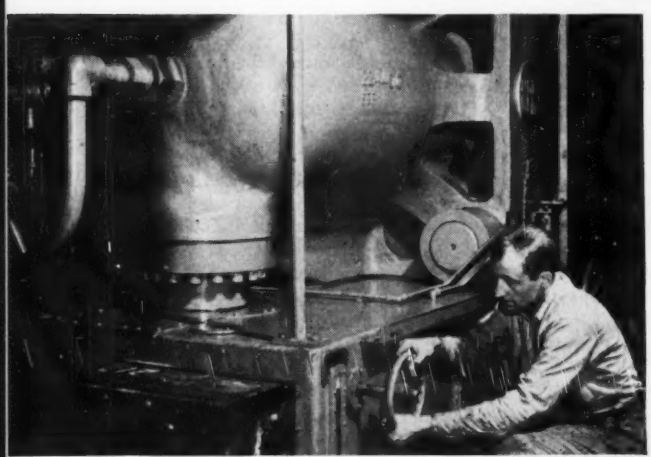
PRESSURE LOSSES ENDED. There are few plastic molding machines as big as this 60 ounce model. It exerts a pressure of 1,000 tons. Because the hydraulic oil formerly used sludged up and thinned out, it could not maintain this pressure. But Sunvis 999 has fully met these severe requirements, as well as those of Rona's nine other hydraulic machines of varying sizes.

PLASTIC MOLDER'S BOTTLENECK ENDED BY SUNVIS HYDRAULIC OIL

More than a year ago Rona Plastic Corporation, New York City, had trouble with its hydraulic molding machines. The machines functioned erratically due to oil sludge sticking the control mechanisms. In addition, the oil thinned out excessively at normal operating temperatures, and resulted in the loss of proper clamping pressures on the dies. To keep the machines going at all, it was necessary to drain, clean, and entirely recharge the systems at frequent intervals.

A Sun representative, called in by Rona, studied the problem and recommended Sunvis 999. He knew it would put an end to pressure losses, because, even at elevated temperatures, it does not decrease in viscosity as much as most other oils. He also knew its exceptional stability would end the sludging problem.

Sunvis 999 proved to be the answer to all Rona's hydraulic oil problems. The original charges, with minimum make-up, are still giving good service. Rona can expect the same performance for a long time to come, because experience shows that under normal operating conditions, Sunvis 900 Series Oils are *good for the life of the equipment.*



NO OIL CHANGES HAVE BEEN NEEDED. Before Sunvis 999 was adopted, the oil in each of the machines had to be changed frequently (the one pictured holds 450 gallons). The original charges of Sunvis 999 have been in use now for more than a year.

Department P-4
Sun Oil Company, Philadelphia 3, Pa.

I am interested in knowing more about Sun Hydraulic Oils. ☐ I would like to consult with a Sun representative. ☐ Send the booklet "Hydraulic Fundamentals and Industrial Hydraulic Oils."

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

TECHNICAL ASSISTANCE AVAILABLE. Sun's engineers are at your service for consultation on all hydraulic oil applications. It will pay you to utilize the experience they have gained in solving a wide variety of problems in many different industries.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO

More PLANT PROBLEMS

Begins on page 132

REPLACE NONRETURNS with either globe or gate valves suitable for the new steam pressure. Change safety valves so they are suitable.

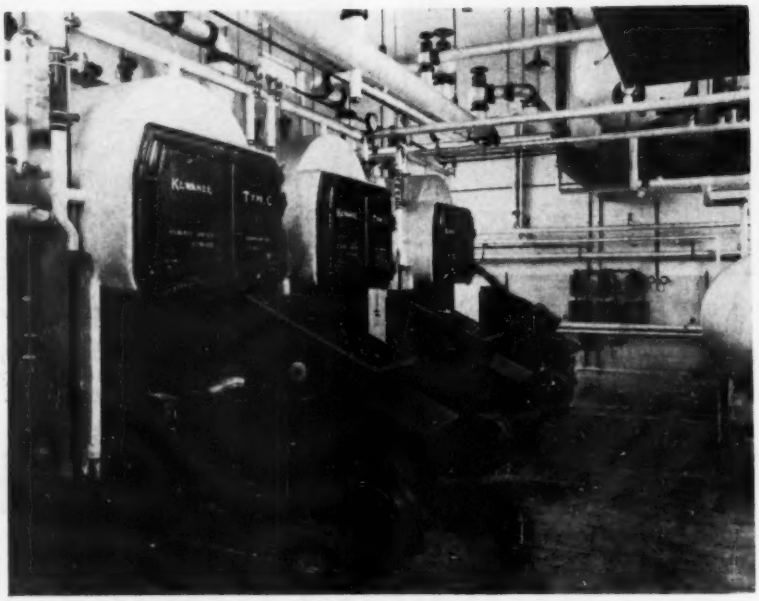
I think *LW* will get better results with a vacuum-return system. Spot individual vacuum tanks and pumps at strategic points in the plant and pipe their discharge to a common vacuum tank in the boiler room. For best results, put boilers on automatic control.

J M Gorrie *Richmond, Va.*

DON'T FORGET to change nameplates on the safety valves if new springs are substituted for the old. Have the boiler inspector approve the safety valves before you purchase them. Present nonreturn valves are satisfactory because they meet code requirements.

Victor J Cotz *Allendale, N. J.*

Other readers sending answers are:
M E Heath *Cincinnati, O.*
C G Howarter *Canton, Ill.*
H W Congdon *Auburn, Mass.*



BEST OUTPUT is obtained from heating plants when they are well-designed for the load they must carry. Be sure to consult code in your area before conversion job

More Answers to "Why Does This Motor Reverse?"

Continued from page 133

with a megger or high-resistance voltmeter. All coils should test within 10 to 15% of each other. Check copper resistance through each coil. These should balance quite closely. Use a Wheatstone bridge or dc current of not more than 10% full-load current. Accurate and low-reading ammeter and voltmeter are also needed.

C W Bell, Sr. *Hazleton, Pa.*

EXCESSIVE CURRENT caused by stalling probably opens an overload control or burns free at a contact somewhere. Then load reverses the motor.

If motor stalls under load, overhaul its controls. Fit brakes to hold the load when overload relays operate. Trouble *GS* has looks mysterious but the answer is simple, once it's found.

E A Roberts *Carlsbad, N. M.*

SWITCH CONTACT tips that don't make good contact can cause this trouble. Or closing spring may be weak. When heavy load is put on the motor, current heats the contact tip, burning it until it no longer makes contact. Then motor is single-phased.

Load reverses motor when it is in the single-phase condition. It will continue to run in wrong direction after load is removed. Opening and closing the switch breaks the oxide film on the contact, allowing motor to run on three phases again. Renew contact tips and check contactor to be sure tips have correct pressure when closed.

R H Wilsey *St. Paul, Minn.*

ONE LEG OF *GS's* circuit is open. I'd say the trouble is in the motor switch because we had a similar experience with an air compressor motor about five years ago. A new switch cured it.

A H Moulton *Pittsfield, Mass.*

A THERMAL INTERMITTENT may be the cause. Look for a loose or oxidized connection that operates at light and normal loads, but overheats and opens under overloads. Overheating is caused by the high resistance of the connection. Expansion causes connection to open.

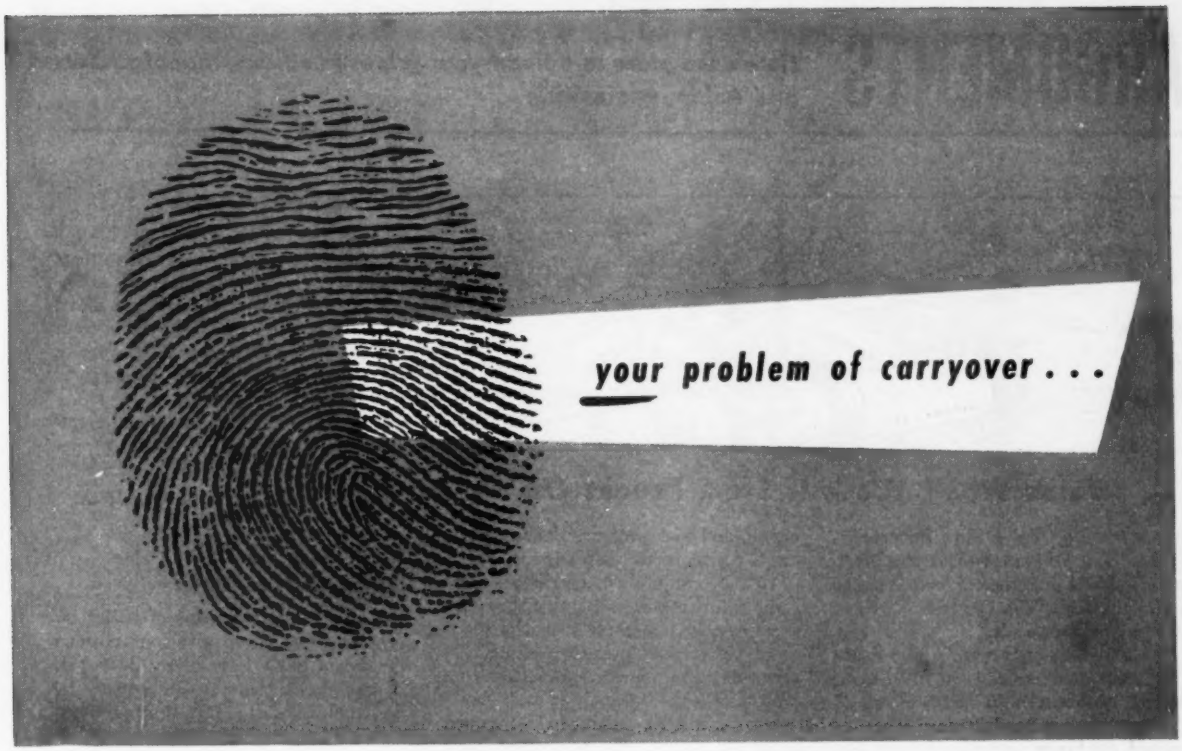
Check wiring while crane runs. Look for excessive heat or signs of overheating. Dirty, oxidized or loose lugs and terminals are sources of overheating. See that contact tips are not excessively burned and that springs do not have too much tension. Discolored springs may indicate overheating.

A high-resistance contact at the motor starter or controller can cause the same trouble when a large current is drawn. Connect three lamps to motor, one across each phase. Run motor until it stalls and see which two lamps go out. Line common to both lamps has the fault. Correct before starting motor.

R T McMillan *Williamson, W. Va.*

PLUGGING RELAY in a quick-stop ac controller may cause this trouble. Defective contacts are the most common cause of poor operation. Clean them and check their closing under load.

A R Eckert *Mt. Vernon, Ill.*



. . . is as individual as a fingerprint. No two problems are alike and there is no standard solution. However, with a comprehensive engineering approach and application of selected anti-foam agents, even an extremely difficult problem can be overcome.

To illustrate the point, a steel mill boilerhouse operating on 100% make-up water, produced 6,000,000 pounds of steam daily to operate its turboblowers. Continuous carryover of boiler water solids with steam was encountered. Regulators and valves were coated with heavy deposits. Frequent slugs of water passed through the superheaters into the turboblowers. And, the superheater temperature charts literally resembled a picket fence!

Betz Engineers recommended the application of proper anti-foam agents and effected a remarkable improvement. Carryover has been *eliminated*, and superheater temperature has been *increased* approximately 50 degrees.

Why not ask a Betz Engineer today to explain how anti-foam agents can help solve your own particular carryover problem and save you time, money and effort in your plant? Ask him too, about the complete Betz *Specialized* Water Conditioning Service tailor-made to your needs. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

Betz Technical Paper 115 "Carryover Prevention With Anti-Foam Agents" is free for the asking. Write for a copy today.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers

Valve Won't Work If Stem Breaks Off

REFERRING TO "Valve Flow Reversed?" (p 136, Jan POWER) I think the better installation is one where pressure enters under the seat. The illustration is correct as you showed it.

Assume that pressure is above the seat and stem breaks in the bonnet thread, or between bonnet and wheel. If valve were closed it could not be opened (to lower water level in an emergency). On the other hand, if it were open it could not be closed, so boiler would have to operate temporarily with only one blowdown valve. It would be better to have the valve open rather than closed, because one valve would be usable and the boiler could run until repairs were made.

In addition, this valve is normally closed, and with pressure the seat packing is not required to do any sealing.

To the best of my knowledge, there is no code requirement that pressure enter over or under the seat of a blowdown valve. For pressures above 100 psi, code requirement is two valves on each blowdown line.

Best operating practice is to open wheel on outer valve first, then blow down by opening the inner one. In closing, inner valve should be closed first, next the outer one. This puts most of the wear on inner valve, lets outer one do good job of sealing. If either stem breaks, boiler can still operate using the other blowdown valve.

F PTACEK *Yarnall-Waring Co*
Philadelphia, Pa.

Consider the Sediment

I AGREE with the editors. Flow through valve (p 136, Jan POWER) is right.

While there is no code requirement that pressure must be under the seat, avoiding a sediment trap is a good reason for preferring this arrangement.

Hazard of accidental blowdown through an open valve, cited by Ryan as an argument for pressure on top of the disk, is very real. I know of at least one boiler completely blown down because of a loose disk. But his proposal for eliminating that hazard only introduces a new one—possibility of a sediment trap.

ASME Boiler Code indicates correct solution. It says all stationary boilers carrying over 100 psi must have two blowoff valves. Possibility of both valves failing at once is negligible.

I think any good engineer will see that his boiler has two blowoff valves regardless of pressure.

E F FERNES *Maryland Casualty Co*
Baltimore, Md.

Watch That Shock!

W RYAN'S ADVICE about reversing valve flow so pressure is against the bonnet (Jan POWER) could be extremely dangerous. He reasons valve would close if stem broke. But sudden closing of valve during passage of high-velocity blowdown water would cause severe shock pressure.

Shock pressure is proportional to volume or weight plus pressure or velocity. Manufacturers' shock tests show that sudden stoppage of flow results in 10 to 100 times the initial pressure. Assuming the boiler pressure at 1500 psi, sudden valve closing would zoom pressure to somewhere between 15,000 and 150,000 psi.

Rupture or failure of valve, piping or joints would follow. An operator (if he lived) wouldn't be able to close valve next to boiler even if valve and piping between it and blowdown nozzle were still undamaged.

ART BELTON *Montreal, P. Q.*

Follow the Arrow

MODERN STRAIGHT-THROUGH blowoff valves are specifically designed so there is no need for pressure on top of the disk. Installation with pressure under the disk is correct, as shown in your drawing (Jan "Argument Corner"). This way disk protects packing as valve is opened.

Many valves have a directional arrow embossed on the body to insure proper installation in the blowoff line.

J F CURTIS *Detroit, Mich.*

Why Is 3226 Psi Critical Pressure?

THE BOARD OF EXAMINERS of boiler inspectors asked me to give four reasons why steam can't form above 3226 psi.

I gave them these two reasons: (1) No latent heat. (2) At that pressure steam and water have same density, so you can't tell where the water line is in the gage glass.

Does some reader have a full answer to satisfy the inspectors' question?

A J KUCHINSKY *Arlington, Mass.*

Diesel Cylinder Wear

I'VE JUST READ H P Yount's article, "The Life of a Diesel Liner" (p 110, Aug POWER), and I would like to add a few comments.

Several years ago I surveyed 100 two-cycle diesel engines of 14- and 16-in. sizes. Although I have always felt that wear should be less on a 4-cycle than on a 2-cycle engine, my results confirmed very well the wear of .001 in. per 1000 hr operation, disregarding the first few hundred hours. Also, I found that a wear of .005 in. per in. diameter before replacing or reboring was a pretty good rule to follow.

Wear on direct reversible marine engines was about twice that on stationary engines. I attributed this to the number of starts and stops, and to the fact that salt-laden vapor could be drawn into the cylinders.

Best records were made by engines in ice-plant service, operating continuously for months at a time. Here wear averaged around .0005 per 1000 hr.

I believe that wear is affected by the temperature and quantity of cooling water. An outlet temperature of 135 to 140 F is about ideal, with a circulation of ½ gpm per hp.

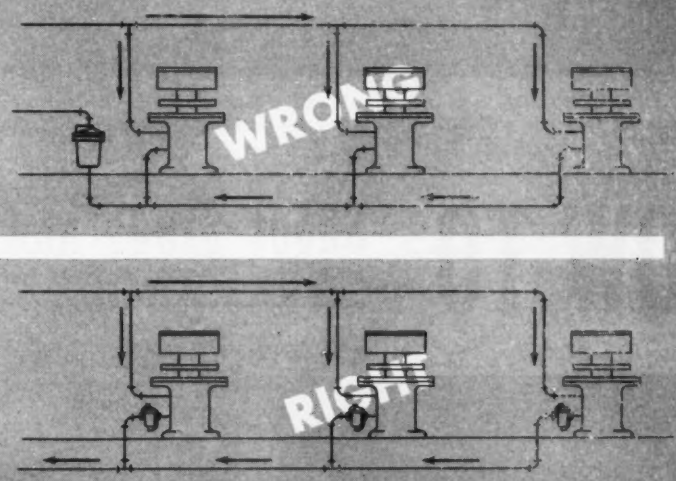
E C COLE *Caracas, Venez.*

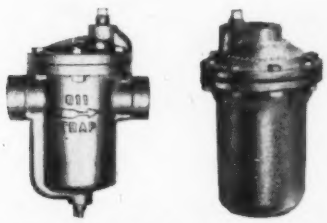
A good trade: How 50 Armstrong traps saved 14 tons of coal per month . . .

User changes from Group Trapping to Unit Trapping

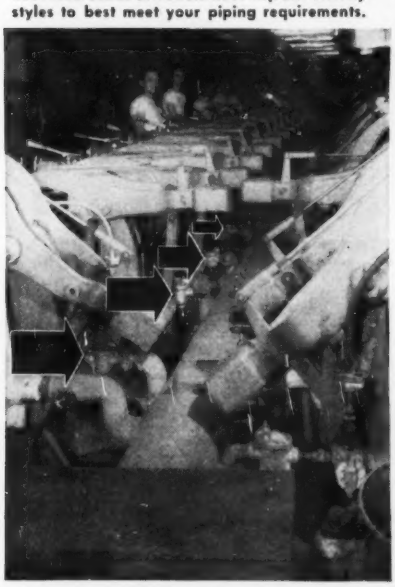
THE drawing labeled "wrong" shows a group of presses drained by a single trap. With this hook-up, condensate and air from one or more presses may fail to reach the trap because even the slightest pressure difference between the units will cause a back flow from a higher pressure unit to a lower pressure unit.

The drawing labeled "right" shows unit trapping, each press drained by a single trap.





Armstrong Steam Traps are available in side inlet-side outlet or bottom inlet-top outlet body styles to best meet your piping requirements.



View of a battery of individually-trapped clothing presses at M. Wile & Company, Buffalo.

AN EXAMPLE of the benefit to be gained from Armstrong Unit Trapping is found in installation at M. Wile & Company, Buffalo, N.Y., clothing manufacturers.

A single steam trap was being used to drain each group of 4 to 6 pressing machines. After changing over to the use of an individual Armstrong trap on each of the fifty presses in the plant, the company reports that, because of the resulting more efficient use of steam, coal consumption dropped by 14 tons a month. There was no reduction in work load. This fuel saving when held up against an investment of about $500 in steam traps was rightly considered *a good trade.*

There are other advantages to Armstrong Unit Trapping. Almost invariably machine temperatures are higher, heat-up is faster and output is increased. The traps themselves are thoroughly reliable, seldom need attention. The design, materials and workmanship in the trap mechanisms for low and medium pressures are identical to those used in Armstrong traps for power plant service at 900 degrees F and 950 lbs. pressure, so they last for a long, long time.

Your local Armstrong Representative will be glad to discuss the savings possible in your plant through Armstrong Unit Trapping. Call him, or write:

ARMSTRONG MACHINE WORKS

812 Maple Street • Three Rivers, Michigan

You Always Get Greater Efficiency When You Use Armstrong Unit Trapping

FREE
44-PAGE
STEAM TRAP BOOK
Gives Complete Details

JUST CLIP TO YOUR COMPANY LETTERHEAD AND MAIL

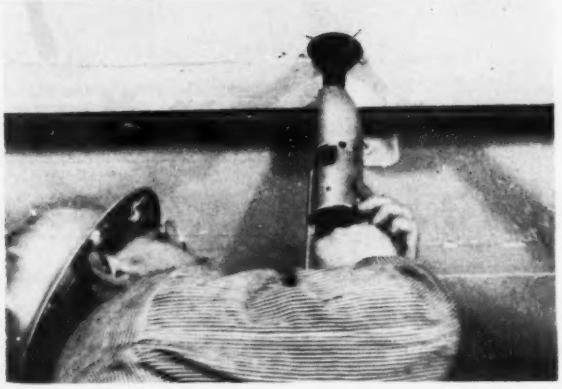
ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Michigan

Please send me a Steam Trap Book.

Name .....

Title .....

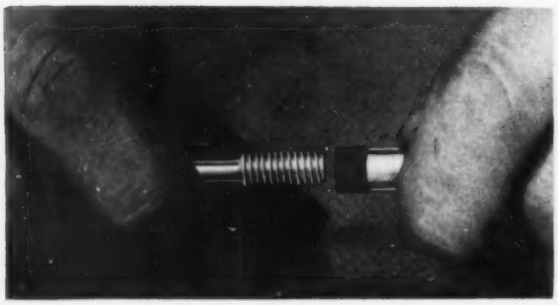
ELECTRICAL CUTOUT BOX is anchored to masonry wall by shooting metal stud into wall with driver using gun cartridge



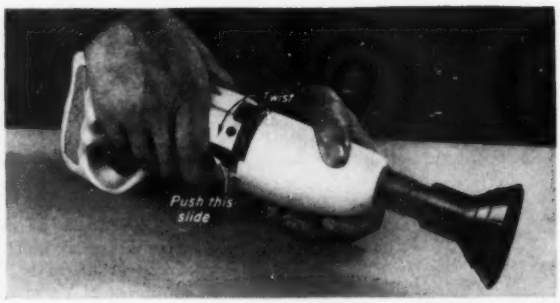
PIPE HANGER anchoring to concrete is no problem. Position marks on driver line up with cross through stud's center

HOW TO Shoot Studs and Save Costly Time

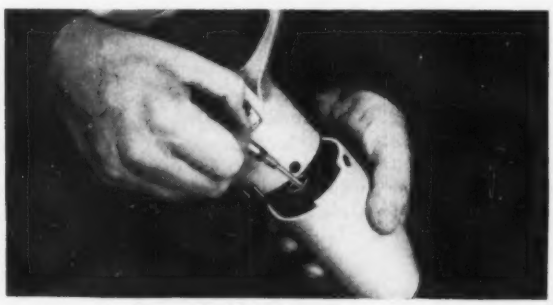
Courtesy, Remington Arms Co, Inc, Bridgeport, Conn.



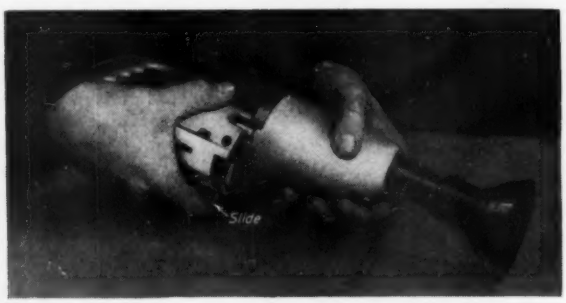
1 Assemble right stud with cartridge of proper load from data supplied by manufacturer. Line up stud and cartridge



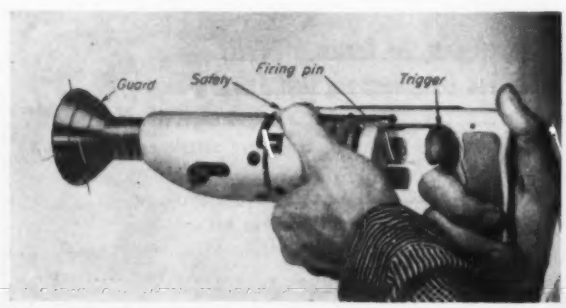
2 Hold housing of stud driver with right hand, and action-tube cover with left hand; push in slide. Twist housing



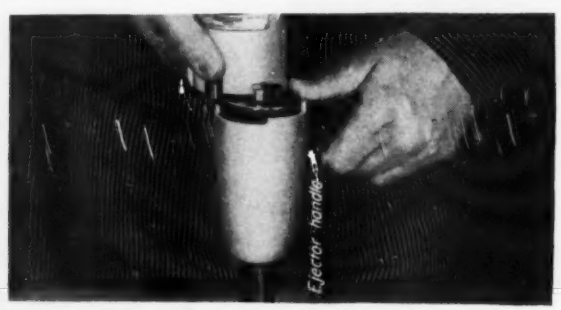
3 With stud driver in loading position, insert assembled stud and cartridge into the driver's chamber as shown here



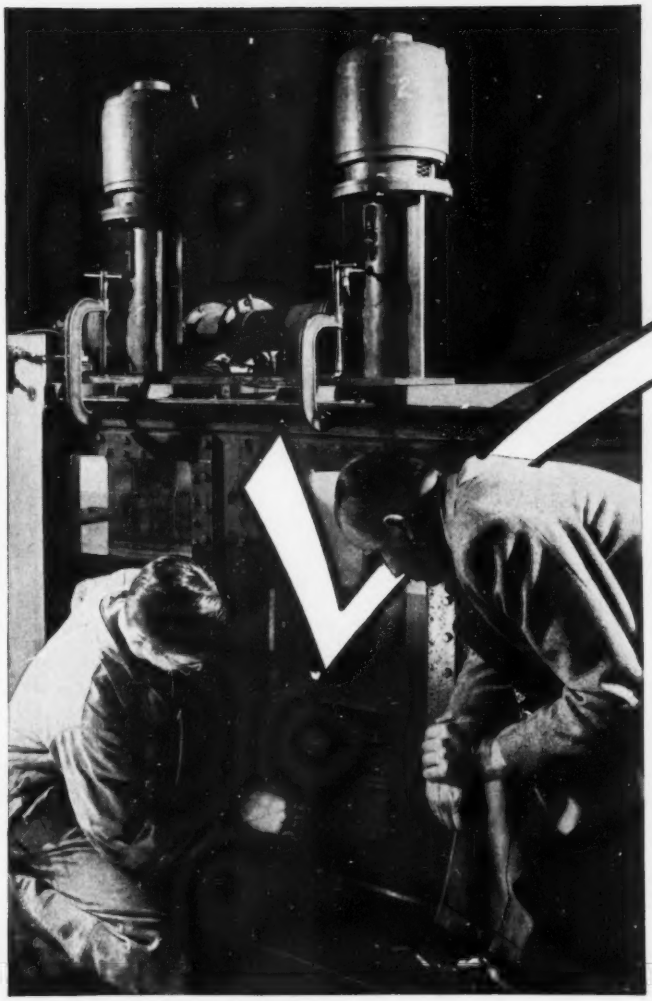
4 Hold slide all the way in. At same time, close the action by twisting the housing counterclockwise to snap shut



5 Firing-pin's red-end is raised, driver is cocked for firing. Position the guard, press the safety, and pull the trigger



6 Open the action and pull back on ejector handle to remove shell. Hold grip end down so shell will fall out freely



PUMP Laboratory Check

Suction Bay and Pump Performance in Advance

Use this Allis-Chalmers pump laboratory to duplicate your suction bay design and operating conditions.

WHY CHANCE EXPENSIVE BUILDING ALTERATIONS when you can be sure of suction bay and circulating pump performance in advance. In the Allis-Chalmers pump laboratory, an exact scale model of your suction bay can be built. Then you observe the effects of different foundation arrangements . . . can check efficiencies under partial load . . . test the ultimate capacity of your design in case of expansion . . . see what happens under different water conditions. This way you can be sure that you have the right design, down to the last detail.

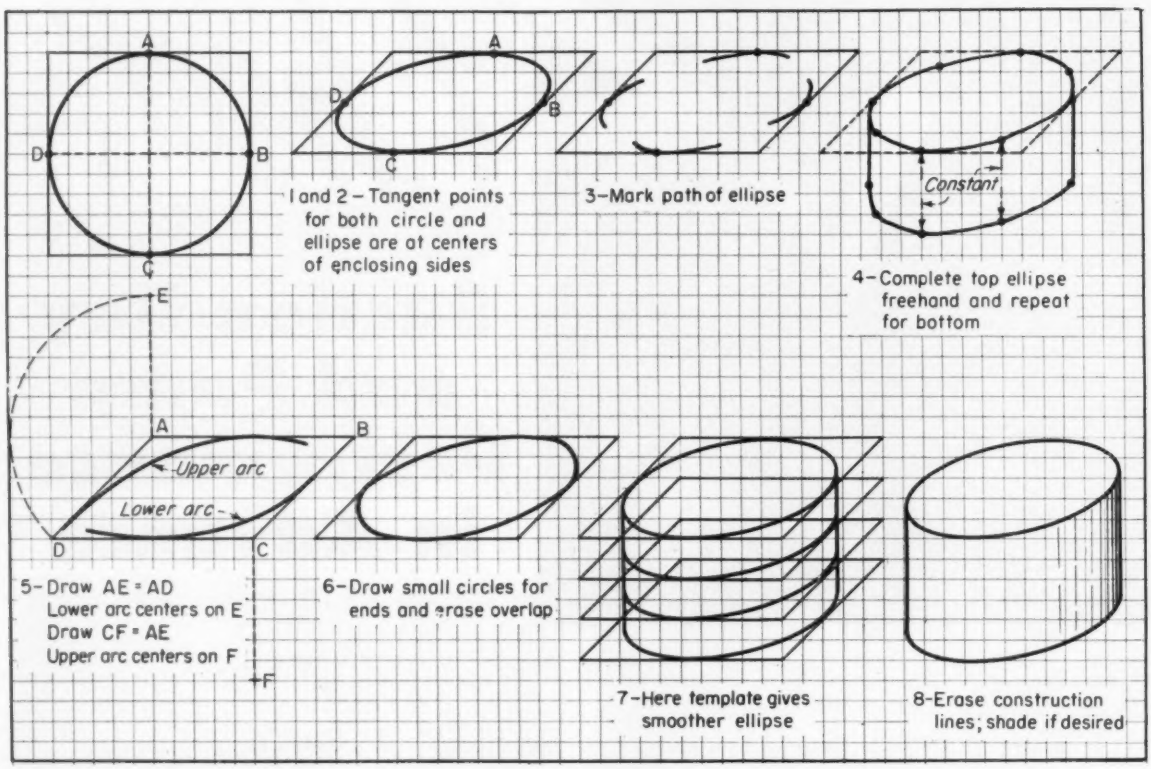
Available to Power Plant Operators and Consulting Engineers

The Allis-Chalmers pump laboratory is located at the West Allis, Wisconsin, Works and is available for use for all power plant operators and consulting engineers with large pump and water supply problems. For details of the services available, call your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3973

ALLIS-CHALMERS

HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



Easy Sketching System — 8

► EVERY ROSE has a thorn, so there is one minor nuisance you may encounter even with cabinet projection.

You won't always be able to draw circles with a compass because you can't always arrange to have the circle face you. When the circle to be pictured is on the top or sides, it appears as an ellipse. Remember, the oblique view of a circle in a square is an ellipse in a diamond. To avoid confusion always draw the diamond first, then fit the ellipse into it.

Four ways to draw the ellipse are: (1) Trace it freehand by eye. (2) Plot the four tangent points of ellipse, then draw it in freehand. (3) Approximate ellipse with four circular arcs. (4) Use ellipse templates.

Templates give the best-looking job with the least effort. Their use will be described next month. This month we show what to do if and when you have no template handy.

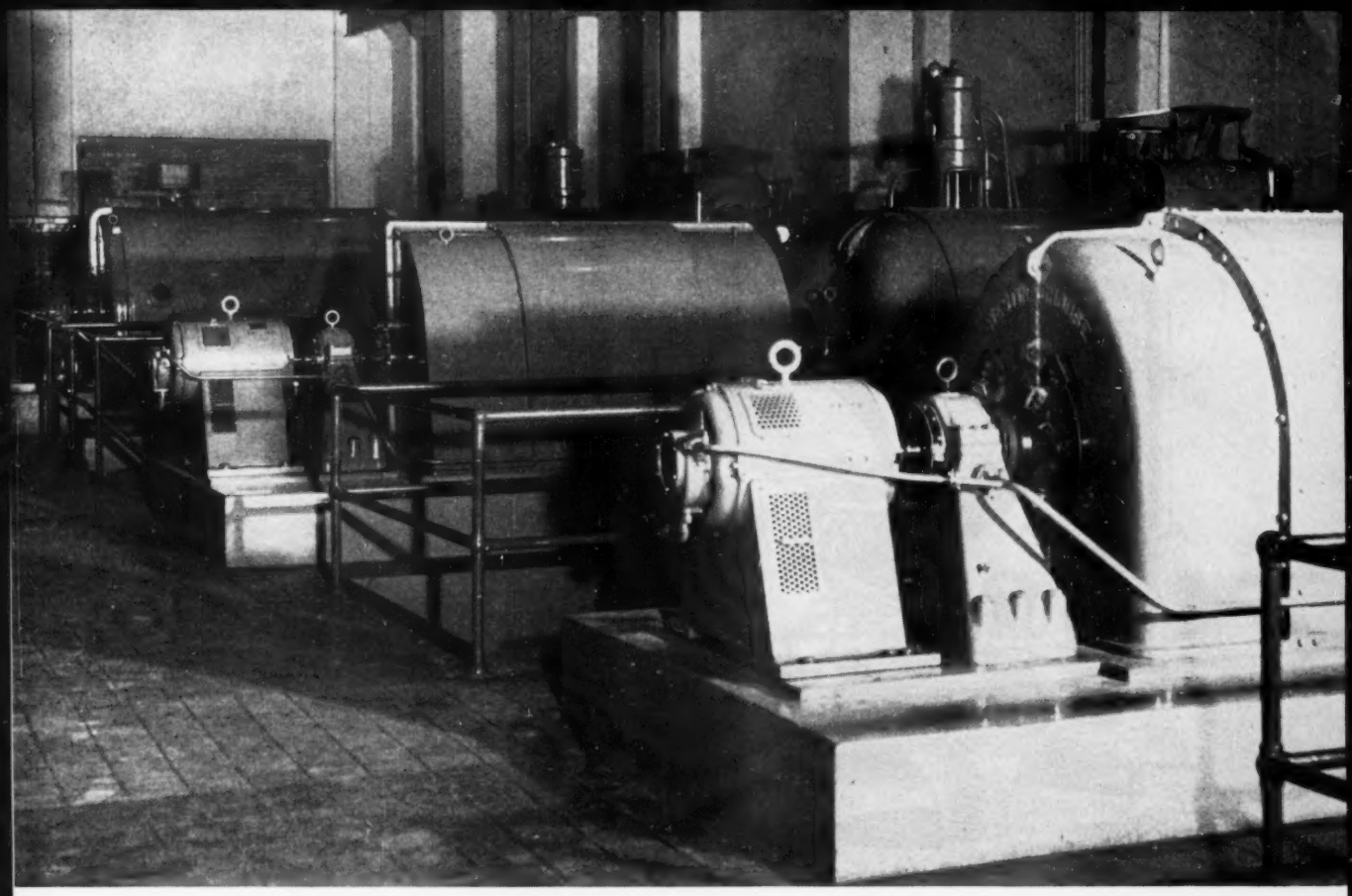
First, note circle in Fig. 1 is tangent to the square at center of each side. The same must hold true for the ellipse in the diamond, Fig. 2. Side centers *A, B, C* and *D* are tangent points.

For a freehand sketch of the ellipse, first indicate the trend of the curve at tangent points, Fig. 3. Then, Fig. 4, complete ellipse freehand by eye. Fig. 4 shows how to expand this into a sketch of a tank. For the near bottom edge, merely repeat (drop down) the near edge of top ellipse.

If you want a smoother job, fake an ellipse with a compass. First, Fig. 5, strike the two big arcs. Then, Fig. 6, draw small-radius arcs tangent to big arcs at each end. Erase overlap.

Fig. 7 was drawn with ellipse templates—cleaner curve with less work. Fig. 8 shows application to a tank.

NOTE: *Next two lessons will be devoted largely to exercises using ellipse templates. You will need specially thin ellipses ("25-deg slant"). We suggest Dietzgen Truway ellipse templates from drafting stores, or direct from Eugene Dietzgen Co, 218 E 23rd St, New York, N. Y. For a template of 20 ellipses, 1/8 to 2 in. long, order No. 2275—25, about $2. For 12 ellipses, 2 1/8 to 4 in. long, order No. 2275L—25, about $3.50.*



Turbine oil with a past . . . and future

• The story of NONPAREIL Turbine Oil in the Water and Light Commission plant, Fairmont, Minnesota, is one of a long successful past and a guaranteed trouble-free future. It's a typical story of the kind of performance offered by NONPAREIL Turbine Oil.

NONPAREIL
TRADE MARK
Turbine Oil

In 1929, NONPAREIL got its start in this plant by solving a sludge problem in a 1500-KW unit. Water could not be separated from the conventional lubricant previously used, and sludge had resulted. Good separation was obtained with NONPAREIL, and sludge troubles were eliminated.

As other units were installed, they were filled with NONPAREIL—a 2500-KW unit in 1938, a 4,000-KW unit in 1945, a 4,000-KW unit in 1949.

None of the original fills of oil has ever been removed from the four turbines, either for reconditioning of the oil or for cleaning of the lubrication systems. Neutralization numbers of the oil fills have remained below 0.09 mg. KOH/gm. There have been no failures or troubles of any kind caused by faulty lubrication.

That's the past of NONPAREIL Turbine Oil in this plant—23 years of trouble-free, cost-free lubrication. What's more, the same effective lubrication is assured for the life of these turbines. Each fill of NONPAREIL is guaranteed by Standard Oil to last for the life of the turbine it lubricates and to maintain a neutralization number below 0.15 mg. KOH/gm.

A Standard Oil lubrication specialist will be glad to show you lubrication records of NONPAREIL in installations similar to your own. In the Midwest, you can contact him by phoning your local Standard Oil office. Or write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY **STANDARD** *(Indiana)*

"Bilgewater on knibbling pins," roared Marmaduke Surfaceblow when I threw the letters on his desk

The Scored Ram

► OUR CHIEF EDITOR, Phil Swain, had an interesting question thrown at him while acting as chairman of a sectional conference at the Maintenance Show in Cleveland this year.

"What's a KNIBBLING PIN?" was the question. If you readers remember, Marmaduke Surfaceblow sounded off about the 200-lb knibbling pin that Chief Engineer Grogan took ashore in Shanghai, January POWER.

Ever since, letters have been flooding us. Everyone wants to know what part of the engine that pin is in, or what it does. So yesterday we decided to find out.

I headed over near the waterfront to Marmy's dingy office above O'Houlihan's Machine Shop & Engine Works. Climbing the creaky stairs to the second floor, I stopped in front of the door with the bright red sign reading *Marmaduke Surfaceblow, Esq, Consulting Engineer*. The door was ajar. Tobacco smoke coming from inside told me not only that Marmy was in, but also that he had a full head of steam up on his boiler.

Inside, the tough old sea horse was firmly anchored with his stern in the battered swivel chair and his long legs propped up on his roll-top desk. He reminded me of the bowsprit poking ahead of an old square rigger. A large blueprint lay on his slightly bulging midship section. Marmy, who had been through so many sea and land campaigns, was studying the print intently through a cloud of smoke, as if charting a course for some tropical island.

"Here's a stack of mail about that story in the January issue," I said cheerfully, dumping it on his desk. "Your public wants to know what a KNIBBLING PIN is."

"BILGEWATER ON KNIBBLING PINS," roared Marmy, shoving the blueprint to one side and glaring at his mail. "I'll tell you about a tough hydraulic packing problem that was solved by common, everyday horse sense." I grabbed a chair. Marmy blasted away.

"Back in 1928, I was a millwright for a large rubber company in Akron, Ohio," roared Marmy, like a hungry lion. "We had a string of 1500-psi hydraulic presses. They had rams of 18, 24 and 36 in. diameter, and were used for pressing automobile tires. Those were good Republican days and the presses worked steadily to help put two cars in every garage.

"My job was installing new equipment in a new wing of the old plant. One day I heard the boss was in trouble. Seems that grit had gotten into the liquid of a 36-in. ram and burred it up so the large turns of leather packing were torn up with every stroke of the ram.

"That press was a giant and badly needed at that time. The boss couldn't shut it down without laying off a lot of help affected by its work. Besides, shutting down meant losing a lot of business.

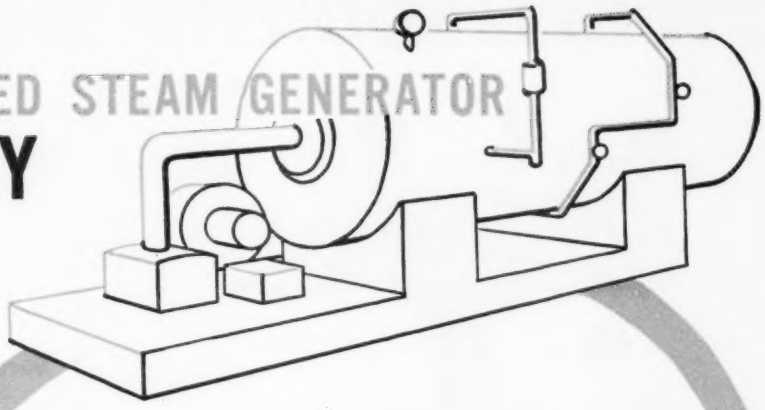
"They tried repacking the ram, but after a few strokes the liquid would squirt all over the plant, almost as if there was no packing in the stuffing box. So the plant engineer called in his maintenance foreman and asked him for advice. The foreman suggested tearing down the press, moving the ram to the machine shop and grinding it down smooth. But tearing down a press with a 36-in. ram is no small job. That would take days and cost thousands of dollars for repairs, besides lost production.

"Suggestions were given by almost everyone in that department. Various mill-supply houses handling packing

(*Continued on page* 190)

Ideal Combination

FOR TOP SELF-CONTAINED STEAM GENERATOR EFFICIENCY



1

Nalco WATER TREATMENT

SCALE AND CORROSION PREVENTION

With a Nalco Service Policy and Nalco Chemicals to fit your water treatment requirements, you can keep your self-contained boilers operating indefinitely at top efficiency — without any of the costly difficulties caused by scale and corrosion. This part of the Nalco System was designed expressly to provide small boiler users with the same complete water treatment services enjoyed by thousands of the country's largest power plants. A new 4-page bulletin gives complete details on The Nalco System as applied to the modern self-contained boiler. Your copy will be sent promptly, without obligation.

Write for Bulletin 49

2

Nalco SR-155 FUEL OIL ADDITIVE

FUEL SAVING . . . CLEAN BURNERS

Nalco SR-155 is a *complete* fuel oil additive. It replaces two, three or more single-purpose additives to: (1) keep storage tanks, fuel lines and burners free of sludge and gum; (2) prevent soot formation in the firebox and flues; (3) inhibit corrosion throughout the fuel system; and (4) act as a combustion catalyst to assure complete burning of oil. Fuel savings and reduced maintenance costs usually more than repay the cost of continuous SR-155 treatment — and very little SR-155 is needed per 1,000 gallons of fuel oil! Details on Nalco SR-155 will be sent on request.

Write for Bulletin 46

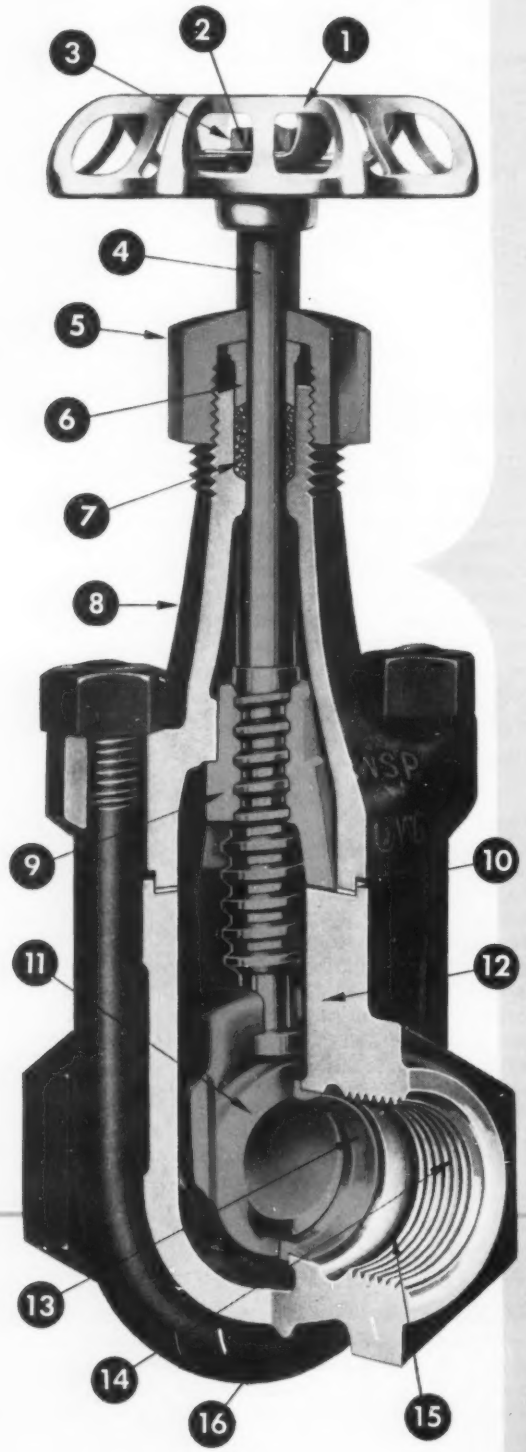
NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE Nalco SYSTEM • Serving Industry through Practical Applied Science

From U-Bolt to bonnet...



1 Perfect-Grip Handwheel

2 Valve Index Plate

3 Secure Wheel Nut

4 Heavy Manganese Bronze Spindle

5 Large Packing Nut

6 Self-centering Packing Gland

7 Deep Stuffing Box

8 Heavy Duty Bonnet

9 Unique Renewable Bonnet-Saver Bushing

10 Body-Bonnet Safety Joint

11 Extra-Wide Gauge Reversible Bronze Wedge

12 Heavy Duty Body

13 Bronze Seat Rings, Expanded in

14 Full Length Pipe Threads

15 Liberal Diaphragm Clearance

16 Strong U-Bolt

JENKINS
U-Bolt Gate Valves

Fig. 42-A, Bronze Mounted Fig. 40-A, All Iron
Screwed: 150 lbs. Steam — 225 lbs. O.W.G. 1/4" to 3"

Fig. 43-A, Bronze Mounted Fig. 41-A, All Iron
Flanged: 125 lbs. Steam — 175 lbs. O.W.G. 1½" to 3"

it has SAVINGS written on it

Only Jenkins U-BOLT GATES measure up to this 16-point standard

TROUBLE IS RULED OUT! Check these 16 advanced features—for wear-resistance . . . for ease of maintenance. From handwheel to diaphragm, notice how thoroughly trouble has been ruled out in designing this U-Bolt valve. No other valve in its class measures up to Jenkins U-Bolt Gate on all these points, many of them exclusive.

You can take it apart and put it together again in two minutes, and it's a cinch to clean. When operating threads become worn, just slip in a new "Bonnet Saver Bushing" and restore it to new-valve efficiency. It's a favorite for those plumbing-heating, mine, mill or any services where excessive sediment is tough on valves and where freezing is a hazard. You can get it bronze-mounted or all-iron, screwed or flanged.

For "renewability" without waste, bull-necked endurance, and low upkeep cost, you can't beat Jenkins U-Bolt Valves. Yet they cost no more! Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.

BONNET-SAVER BUSHING — enables you to renew the bushing instead of junking the bonnet. Just slip in a new "Bonnet-Saver Bushing" and spindle threads have a new full bearing in the same old bonnet.

EASY TO CLEAN — You can really get into the bonnet of this valve to clean out the chamber above the operating threads, to remove wear-accelerating sediment.

RUGGED CONSTRUCTION — Here's proof. When the U-Bolt nut was tightened down with a 14" socket wrench until the high tensile steel bolt broke, the heavy duty body and bonnet did not crack!

Get this Jenkins U-Bolt Gate Valve circular. Form 179 B. It gives full details of construction and maintenance, lists dimensions. Ask your Jenkins Distributor, or write Jenkins Bros., 100 Park Ave., New York 17

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

Oil supplies are up as result of mild winter, drop in export demand and heavy imports. So, lifting of price controls shouldn't result in any boosts, except in a few special cases. Prices of heavy fuel oil have been soft for some time, particularly on the East Coast, and little change seems likely in near future.

As a matter of fact, imports of residual fuel to the Atlantic seaboard have the coal industry worried. They refer to import increases as "dumping," believe it reduces U.S. self-sufficiency. You can look for pressure on Congress to put some kind of limits on oil imports, and fix import duties.

Northwest power users haven't been too quick to resume full use of interruptible power service, ban on which was lifted in mid-January. Marketing conditions in the aluminum industry probably explain hesitance to return to full consumption. Outlook for power supply in this tight region seems favorable for most of 1953. A little steam "peaking" may be needed late in the year.

St. Lawrence seaway is being studied by a bipartisan Senate foreign-relations subcommittee so U.S. participation with Canada isn't a dead duck yet. Meanwhile, Federal Power Commission has completed hearings on New York's bid for a license to construct a 940,000-kw hydro plant and other facilities in the International Rapids section. This license request by the state's Power Authority doesn't involve any U.S. participation in navigation part of project. Lack of opposition at hearings indicates favorable action on the application.

Key power projects associated with power-supply needs of the Atomic Energy Commission – some 50 of them – now have top priorities to procure controlled materials. They will be able to use the AEC program identification "E-5" and will thus have same priority standing as direct AEC orders.

Basic controlled-materials plan, now operating open-ended, remains in effect until June 30. Priority assistance for the electric-power program after that date is now under consideration by defense agencies.

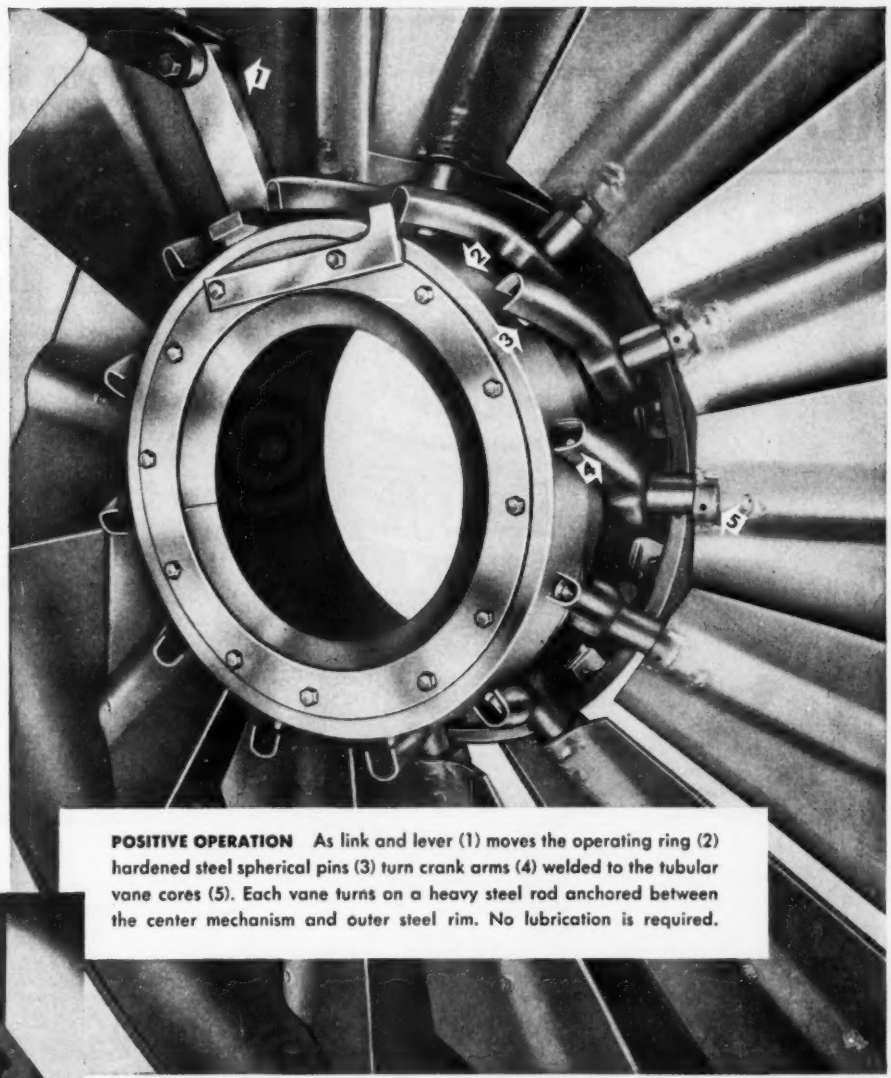
Changes in Russia resulting from Stalin's death are hard to assess and the administration will probably play a waiting game. But it's less likely that there will be any drastic cuts in defense spending, at least until the dust settles.

Mobilization planning will center in the Office of Defense Mobilization. What's left of the various controls agencies, plus the Munitions Board and National Security Board, will probably be pulled under the office of the President. Arthur S. Flemming, acting ODM chief, is expected to stay indefinitely.

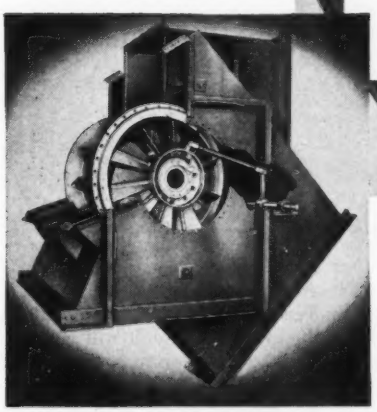
High-temperature-alloy needs for jet engines and gas turbines still put heavy demands on limited supplies of columbium and tantalum. New sources and increased recovery from low-grade ores show promise of easing the picture but both of these rare alloying elements are still under Washington's thumb.

Nickel remains under control and is likely to stay so, in spite of heavy efforts to expand the supply.

SAVE POWER WITH CONSTANT SPEED MOTORS



POSITIVE OPERATION As link and lever (1) moves the operating ring (2) hardened steel spherical pins (3) turn crank arms (4) welded to the tubular vane cores (5). Each vane turns on a heavy steel rod anchored between the center mechanism and outer steel rim. No lubrication is required.



Operating mechanism is shielded from the gas stream but is readily accessible from the outside for inspection and maintenance.

VANE CONTROL

CAN SAVE BOTH FIRST COST AND OPERATING COST

The combination of Sturtevant Vane Control and the simple squirrel cage motor is less costly to install and provides greater overall power savings than other types of mechanical draft control. These savings are made possible by simplified design.

Vane Control has no gears—no backlash. It provides instantaneous control of draft. The vanes move rapidly in the open range, yet fine adjustment is possible in the near-closed position. Extremes of heat and cold do not affect its operation.

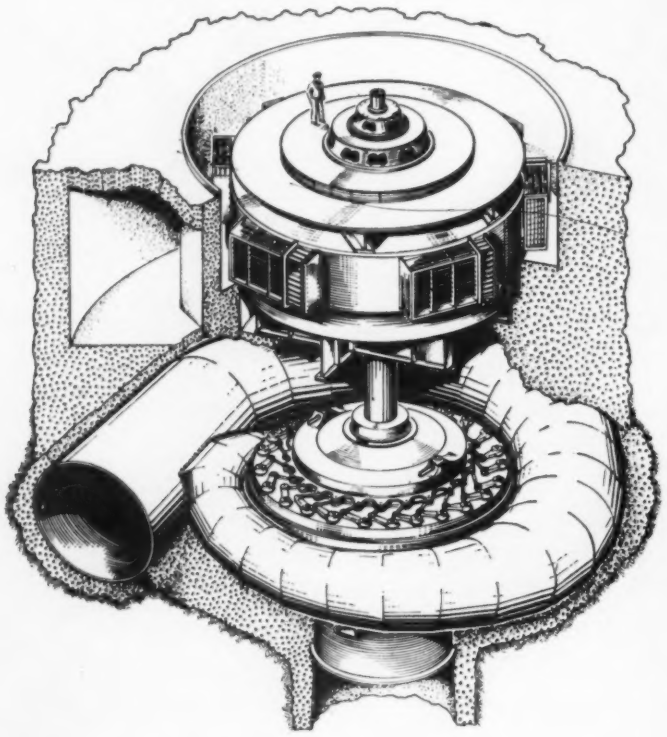
In any comparison of fans and their control mechanisms for use in mechanical draft, as well as industrial applications and ventilating service, you will find Vane Control is both the most efficient and the most economical choice. For full information ask for Folder DB-92-810. Contact your local Westinghouse-Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park. Boston 36, Mass.

YOU CAN BE SURE...IF IT'S

Westinghouse J-80264 STURTEVANT DIVISION

READER SERVICE SECTION

POWER NEWS_____150
TECHNICAL BRIEFS_____152
PLANT EQUIPMENT NEWS_____156
NEW FREE BULLETINS_____165



Coming Events

April 12-15—American Society of Mechanical Engineers, Region VIII annual meeting, Jung Hotel, New Orleans, La. ASME Reservations Dept, Jung Hotel, 1500 Canal St, New Orleans 12, La.

April 13-15—American Society of Lubrication Engineers, annual meeting, Hotel Statler, Boston, Mass. W P Youngclaus, Jr, ASLE, 343 S Dearborn St, Chicago 4, Ill.

April 22-24 — American Institute of Electrical Engineers, Southern district, Seelbach Hotel, Louisville, Ky. H H Henline, secy, AIEE, 33 W 39th St, New York 18, N. Y.

April 28-30—American Society of Mechanical Engrs, spring meeting, Drescher-Warrick Hotel, Columbus, Ohio. O B Schier, mgr, ASME, 29 W 39th St, New York 18, N. Y.

June 15-19—American Institute of Electrical Engineers, summer general meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. AIEE, 29 W 39th St, New York 18, N. Y.

World's Largest Reversible Turbine-Pump

Contracts for the largest electric generator-motor and reversible turbine-pump ever built have been let to the Allis-Chalmers Mfg Co. The equipment will be the heart of a pump-storage project at Hiwassee Dam in southwestern North Carolina on the power network of TVA. It is scheduled for completion late in 1955.

In this installation a single hydraulic machine will operate in one direction as a turbine and in the reverse direction as a pump. A direct-connected electrical machine will serve as a generator for turbine operation and as a motor for pump operation.

When in service, water from Hiwassee reservoir, driving the unit as a turbine-generator, will add needed energy to the TVA system for peak loads. During off-peak periods, when surplus power is available from other plants, the unit will operate as a motor-driven pump to lift water back into the reservoir. In other words, it will act as a huge storage battery for storing energy.

The project has many unusual aspects. The reversible pump-turbine will use the largest francis-type runner ever built. As a turbine it will have a maximum rating of 120,000 hp. When motor driven, the unit will have a pumping capacity of 3.3 billion gallons per day, nearly three times as much as New York City requires daily. Each irrigation-pump at Grand Coulee is rated at 1 billion gpd.

The generator-motor is equally imposing. As a motor it will be the world's largest, rated 102,000 hp at 106 rpm. It will develop about 50% more power than the motors driving the Grand Coulee pumps. As a generator it is rated 70,000 kva, 13,800 v.

In a normal cycle of operation, the pump will begin lifting 5200 cfs of water from Apalachia into Hiwassee lake under a 135 ft head. When the upper reservoir is filled, head will increase to 254.5 ft, and pumping capacity will drop to 3900 cfs against a 205 ft head.

At the beginning of turbine operation with a full reservoir, the unit will generate 120,000 hp and drop to 36,000 hp as the reservoir approaches its low point. Guaranteed efficiencies are 90% as a pump and 89.5% as a turbine.

Application of this type of unit is economical because low-cost off-peak power is used for pumping, and after which the same water generates high-cost peak-load power.

Cleaver-Brooks Acquires Escher-Wyss American Rights

The Cleaver-Brooks Co of Milwaukee, Wis., has been granted broad sales and manufacturing rights for the North American continent by the Escher-Wyss Co of Zurich, Switzerland. The arrange-

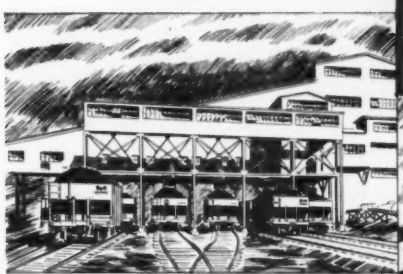
(*Continued on page* 204)

Are you keeping FUEL COSTS as low as you can?

ASK OUR MAN!

He will demonstrate with facts why your best bet is bituminous coal. He will help you find the right kind and size of coal for your specific need; and he will show you up-to-the-minute ways of burning it efficiently and economically.

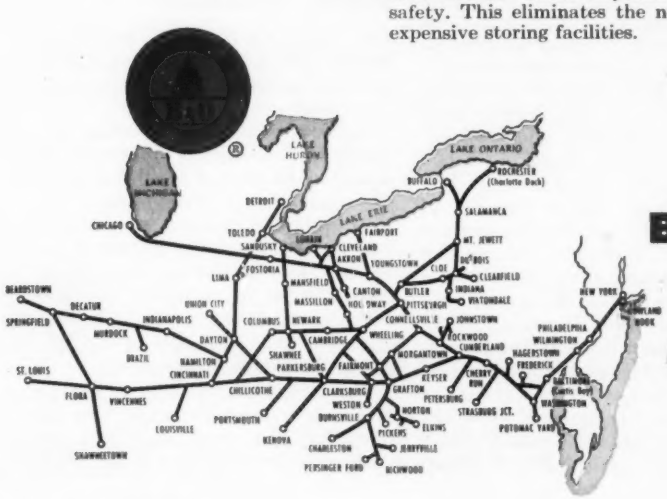
In Baltimore & Ohio territory, close to industry's doorstep, are bituminous coals of all varieties—for power, coking, steam, heating. Produced in highly mechanized mines, these coals are low in cost and uniform in size and quality. With the modern burning equipment now available, the efficiency and cleanliness of bituminous coal will amaze you!



Surprising economy. Conveniently accessible and highly efficient in modern use, bituminous coal from mines on the B&O keeps fuel costs low.

Convenient storage. Bituminous coal can be stored anywhere with safety. This eliminates the need for expensive storing facilities.

Reserves for centuries. Plants built for bituminous coal are assured a continuity of fuel supply regardless of emergencies. On the B&O alone, are reserves estimated at 25 billion tons!



Baltimore & Ohio Railroad

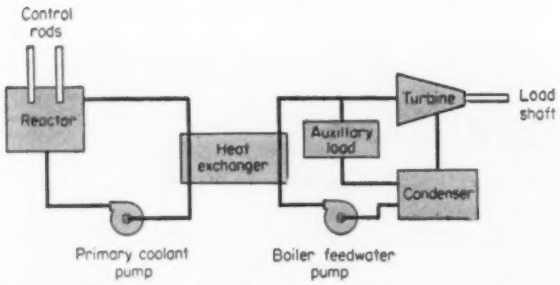
Bituminous Coals for Every Purpose

TECHNICAL BRIEFS

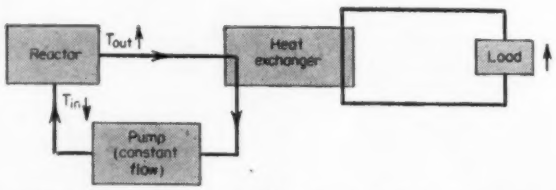
Latest engineering developments for busy power men

12 Digests for you on:

NUCLEAR POWER
WATER TREATMENT
STEAM GENERATION
FUELS AND FIRING



ELEMENTARY BLOCK diagram of possible nuclear power plant. Reactor is merely source of heat energy. Heat is extracted by coolant, transferred via heat exchanger to turbine system



HEART OF CONTROL for nuclear plant is its primary coolant operating cycle. Desirable goal is reactor whose overall reactivity decreases as reactor average temperature increases

Nuclear Power

Nuclear Power Plant Control Considerations. *By M A Schultz, Westinghouse Electric Corp.*

The development procedure for designing the control system for a nuclear power plant is basically the same procedure as for any other type of power plant but the presence of a nuclear reactor as a component in the system imposes many unusual design problems. This article reviews general plant considerations affecting control system design giving special emphasis to the features of reactor control.

The basic method of approach to control system design consists first of studying the plant operational requirements and the plant control requirements. Following this review a preliminary block diagram of a control system to fulfill these requirements may be attempted. However, after a study of this diagram, it often becomes apparent that the inherent dynamics of the plant and the characteristics and limitations of some of its components are of utmost importance. Modifications are then made to the proposed block diagram. Once the desired operation of the control system is fully understood, the problem of synthesizing the control system can begin.

For the sake of illustration an elementary block diagram of a possible nuclear power plant is shown left, above. Here the reactor is considered merely as a source of heat energy. When this heat is extracted by passing a coolant through the reactor, the heat energy is then transferred via a heat exchanger to a turbine system, and the output shaft of the turbine can be made to drive many types of working apparatus. The primary coolant considerations are basic for control design, and it may be mentioned in passing that gas, water, —and liquid metals have been proposed as reactor coolants.

Start-up and shut-down requirements affect the control system. Here the nuclear reactor plays a prominent part in determining plant performance for nuclear reactors cannot be started up too fast and never can be really shut down. In considering the output of the nuclear reactor there is no such thing as "zero power" involved, right, above.

Even in a brand new cold clean reactor which has been shut down as much as possible an inherent source of neutrons exists which causes a certain amount of nuclear fission to occur. This fission produces minute amounts of power and in the process more neutrons are released. This effect requires that the reactor neutron output be monitored continually to see that the neutron level is kept under control. In practical cases this monitoring means that instrumentation for measuring neutrons must be capable of operating over ranges as wide as 6 to 10 decades and control provisions must be provided over a similar range.

Starting up a reactor from a cold condition means that the reactor can operate over a neturon range of many decades before any appreciable useful power begins to occur at the output. Some arbitrary number of neutron fissions has to be taken as zero power. For example 1% of full load output might be considered to be the equivalent of zero power. Transitions between 1% full power and 100% full power can be made relatively rapidly, but because of the safety aspects involved, transitions from a cold start-up must be made quite slowly. *AIEE Paper No. 53-31.*

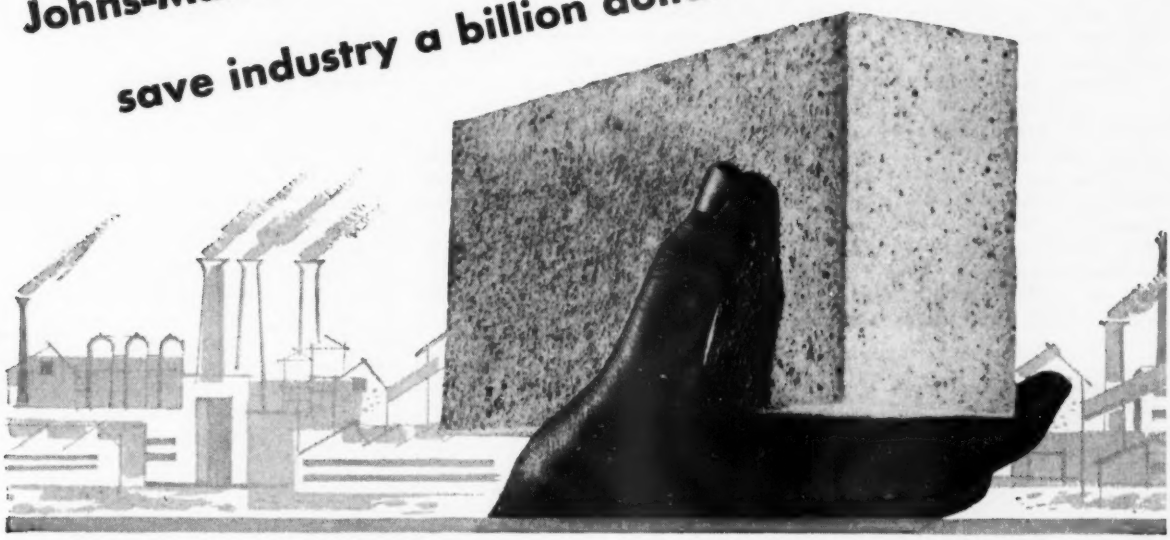
Water Treatment

Conversion of a Two Stage Hot Process Water Softener. *By G H Gowdy, Negea Service Corp and S B Applebaum, Cochrane Corp.*

In 1949 a 16,000 gph two-stage hot-lime-soda hot-phosphate softener was installed in the Kendall Square station of the Cambridge Electric Light Co to treat up to 30% make-up for two 1350 psig boilers evaporating 200,000 lb per hr each. In 1951 make-up demands exceeded 20,000 gph at times. A storage tank was considered to supply the peak demands. But conversion to hot lime zeolite proved more economical.

The second-stage phosphate settling tank now operates in parallel with the first stage tank providing 32,000 gph settling capacity. Three more filters

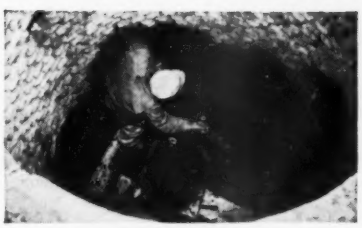
Johns-Manville Insulations save industry a billion dollars in fuel every year!



Reduce your fuel costs and build better furnace linings with JM-3000 INSULATING FIRE BRICK

HERE'S THE ONLY insulating fire brick that withstands a full 3000F. It's highly efficient both as an exposed refractory lining or as back-up insulation. And JM-3000 is only one of six types of Johns-Manville Insulating Fire Brick made for these applications. All provide long-life insulation. All are light in weight, have low conductivity, high structural strength. These properties permit thinner furnace walls—yet you can achieve important fuel savings and increased production, because J-M Insulating Fire Brick assures quick furnace response.

Sil-O-Cel* Insulating Brick is another outstanding J-M fuel-saver . . . a high load-bearing brick for back-up insulation behind refractory linings. It comes in three types, for service through 2500F—makes it possible to reduce the necessary thickness of refractory linings as much as one-third.



Save fuel with J-M Hydraulic Setting Refractories

Johns-Manville refractories meet every need for castable, troweling and gunning applications for temperatures through 3000F. *Firecrete** is used to cast special shapes of all kinds. It is ready for use within 24 hours, has negligible shrinkage and high resistance to spalling. *Blazecrete** is used to build and repair furnace linings. When gunned, it adheres readily with a minimum of rebound loss. When slap-troweled, it eliminates laborious ramming and tamping.

Save Fuel with J-M Aggregates and Fills

These lightweight insulations are used as fills to conserve heat in irregular spaces where other forms of insulations cannot be economically applied. They are also used as aggregates for mixing with other materials to form insulating refractory concrete.

*Reg. U. S. Pat. Off.

Send for your free copy! This new booklet IN-115A gives full details about J-M insulating materials for service through 3000F. To find out how they can help cut your fuel costs, simply mail coupon.

JOHNS MANVILLE PRODUCTS

Johns-Manville FIRST IN INSULATION

Johns-Manville, Box 60, N.Y. 16, N.Y.
(In Canada, 199 Bay St., Toronto 1, Ont.)
Please send me, without charge, copy of brochure IN-115A

Name_____

Company_____

Street_____

City & Zone_____ State_____

were added and three new hot zeolite units were mounted over the filters to save space.

Improved results obtained:—

(1) Alkalinity and CO_2 in steam cut in half. (2) Phosphate deposits in economizer and heaters eliminated. (3) Operating cost reduced from $7.86 to $4.30 per 1,000,000 lb. (4) Total solids reduced 16% and boiler blowoff reduced 25%. (5) Operating control simplified by eliminating soda ash and other chemicals by adding phosphate direct to boilers. *ASME Paper No. 52-A-96.*

Contamination of Condensate by Heat Exchanger Tube Alloys. *By J D Ristroph, Virginia Electric & Power Co and E B Powell, Stone & Webster Engrg Corp.*

The accumulation of foreign metal and metallic oxides on the internal heating surfaces of high pressure boilers has become a source of growing concern to the steam power industry in the United States. Especially over the past ten years with the advent of the 2,000 psi and higher pressure, steam generators, such deposits have been found serious hazards. These deposits all retard heat transfer and so tend to produce a high temperature in the tube walls, leading in turn to overheating or corrosion or both. Deposits of copper origin seem to have the further objectionable property of masking the evolution of hydrogen from the affected surface, which might otherwise give advance warning of the impending failure. Operating experience has pointed to corrosion and solution of metals of the steam-condensate-feed-water part of the system, external to the boiler proper, as normally the major source of the boiler heating surface metallic deposits in the so-called 100%-condensate-feed-water type plant to which the present paper directly refers.

Virginia Electric and Power Company decided to investigate heat exchanger tube alloys as potential sources of metallic contamination of condensate flowing in contact with them. The test equipment employed steam condensate as actually produced in the power plant and otherwise followed conditions of normal operation. In addition, it was used to investigate the influence of such special chemicals as might promise reduction in corrosion and solution of piping and other parts of the steam-condensate system.

Results are presented from condensate contamination studies conducted at two steam power stations to evaluate the influence of temperature of condensate, of differing dissolved gas content, and of cumulative service time upon the degree of metallic contamination to be expected in steam condensate of the general character described from flowing contact with tubing of twelve alloys commercially used in power plant heat exchangers. The influence of cyclohexylamine on the rates of contamination is also indicated. The testing procedures are briefly described. *ASME Paper No. 52-A-63.*

Protection of Heat Exchanger Channels and Covers from Salt Water Corrosion. *By Wilfred J Danziger, Olaf A Sundholm, M W Kellogg Co.*

In the usual shell-and-tube heat exchanger used as a cooler or condenser with fresh water as coolant, the channel, the channel cover, and the floating-head-cover are made of steel or cast iron.

When salt water serves as a coolant, the normal corrosion of steel and cast iron by salt water is accentuated by the galvanic cell set up by the combination of non-ferrous tubes and tube sheets with the ferrous materials under discussion. Rapid failure of the ferrous parts results. This paper describes some of the materials and methods used in petroleum refineries to obtain reasonable life for channels, channel covers, and floating heads when using salt water, together with information on performance where obtainable.

There are, unfortunately, no standard compositions of "fresh," "brackish," or "salt" waters, so that local conditions can have a considerable effect upon performance.

Within these limitations, it appears that cast iron or steel channels and floating covers in fresh water service will have a probable life of four years before requiring any significant amount of maintenance, and 10 to 15 years total life is not uncommon.

In salt water service, steel is unsatisfactory. One refinery reports that steel channels require repairs in 8 to 14 months; another that they usually fail within three or four months. A third reports that "salt water attack on unprotected steel is extremely rapid, and we do not use it in these services except as a stop-gap measure." The life of cast iron also seems to vary considerably with local conditions of the salt water, as evidenced by these judgments at varied geography: failure inside of two years; failure of channels in 18 months, of floating covers in 9 months; life of 6 to 10 months, no better corrosion resistance than steel. Although cast iron appears, in some cases, to have more resistance to corrosion than steel, steel can be fairly easily repaired by welding and any corrosion is visually evident. Corrosion of cast iron leaves a weak, porous, graphitic structure, so that extent of damage cannot be determined by visual inspection.

Brackish water is generally found near the mouth of slowly-flowing rivers. The salt content varies with the river and, for a particular river, with the varying flow resulting from rain or dry spells. With low salt concentrations and low water temperature, corrosion of steel and cast iron is slow; at higher levels corrosion approaches that of sea water. Thus, it has been reported that the cast iron channels of four condensers installed in 1926 in Harrison, N. J., and cooled with Passaic River water gave no trouble for several years. The building of Wanaque Dam in the headwaters of the river and diversion of some of the impounded water resulted in the tides encroaching further upstream. By 1930 the river water at the installation was brackish. A year later parts of the channels were found to be badly corroded, and corrosion continued until corrective measures were undertaken. The reported average salt concentration was 304 grains per gal in approximately the last 6 months of 1933; 161 grains per gal in the following 4½ month period; and 525 grains per gal in August and September of 1934. For com-

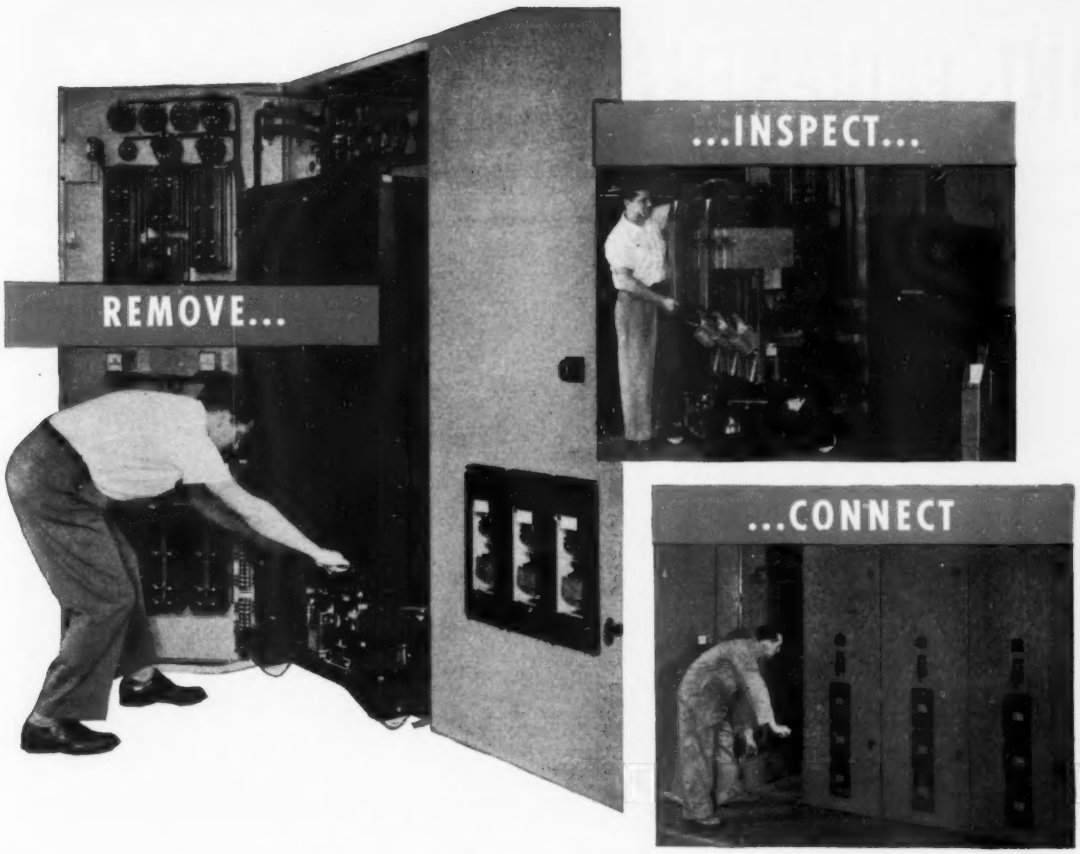
(*Continued on page* 210)

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York, N. Y. Nov 30-Dec 5, 1952. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.

American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York, N. Y. Jan 19-23, 1953. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, N. Y.



It's easier, faster, safer with Westinghouse horizontal drawout switchgear!

You can remove breakers, inspect them, and replace them in only a few minutes when you use Westinghouse Type DH Metal-Clad Switchgear. Because breakers are drawn out horizontally, no lowering or lifting is necessary. A shutter indicator, visible from the front, provides positive indication of disconnect position. As the breaker is withdrawn, a grounded metal shutter closes to isolate stationary contacts.

When the breaker is removed, interphase barrier and arc chutes remove easily to expose contacts at an accessible and convenient working height for quick inspection.

Replacing the breaker is just as easy and safe. A few easy turns of a crank move the breaker from disconnect to operating position. A mechanical interlock positively prevents engagement of crank linkage unless the breaker is open.

For complete information on Westinghouse Metal-Clad Switchgear for indoor or outdoor service write for Booklet B-5306. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-60792

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

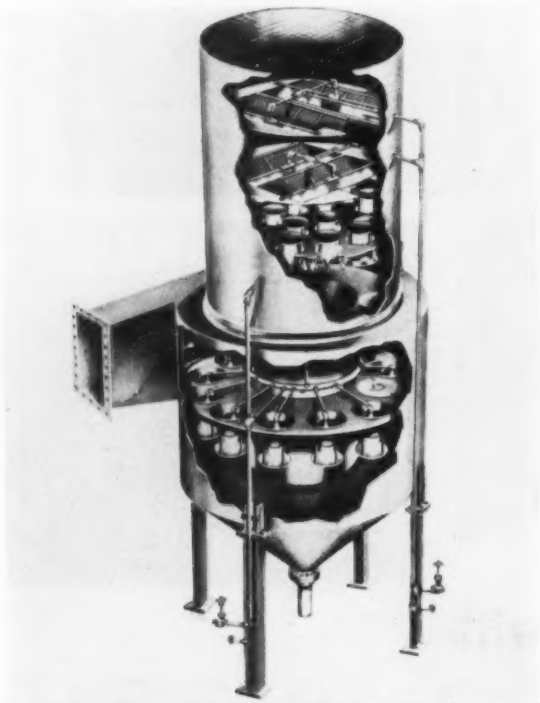
YOU CAN BE SURE...IF IT'S Westinghouse

METAL-CLAD SWITCHGEAR

PLANT EQUIPMENT NEWS

Your information center for new products designed to solve plant problems

Published monthly as a service to readers



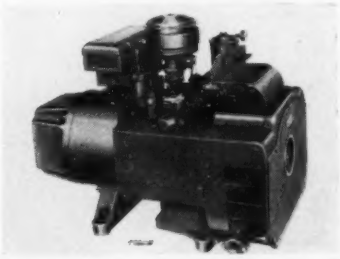
Multiple-Action Stack Dust Scrubber

432 • New system for controlling stack dust combines several principles of dust precipitation. Device is known as the liquid precipitator multiple-action scrubber (type V), has capacities from 1500 to 48,000 cfm. Height ranges from 14 ft 10 in., to 32 ft 10 in.

All dust removed is reduced to a watery sludge that can be discharged into a tank or pond. Recirculation can be used where water supply is limited. For best results, system requires 2 gpm of water at 40 to 50 psi for each 1000 cfm.

Among separation principles used in the scrubber are centrifugal and inertial separation, expansion, contraction and precipitation. Additional stages can be added for greater capacities.

Johnson-March Corp, Philadelphia 3, Pa.



Small Electric Plant

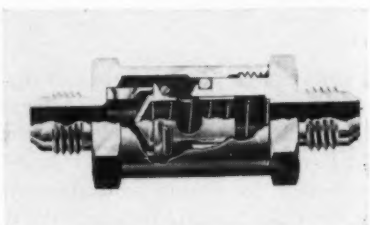
438 • Air-cooled, gasoline-powered electric generating plant has vacuum cooling system. Centrifugal blower draws cold air through generator and over engine, and at the same time discharges heated air out of an 8 by 12 in. side vent.

Model CW is available in 5 and 10 kw capacities. The gasoline engines are twin-cylinder, horizontally-opposed, vacuum air-cooled, 4-cycle type, developed exclusively for electric plant application.

Advantages claimed by the manufacturer include low initial cost, low operating cost, high output with reduction in size and weight per kw, simple installation, operation and maintenance, maximum safety.

D W Onan & Sons, Inc, Minneapolis 14, Minn.

For more data on these items, use post cards p 165. Identify your request with item number.



Flow Limiter Valve

411 • Excess flow or flow limiter valve serves equally well as an automatic drain or dump valve. Unit can be pre-set to close off when any given flow rate is reached. Spring-actuated poppet controls flow. Spring yields instantly as pressure drop reaches desired maximum flow rate, causing a floating "O" ring to seat between two conical surfaces. As an automatic drain or dump valve in a system normally operating under pressure, valve is held closed by the pressure. When the system is shut down, valve automatically opens and allows drainage of any undesired liquid.

James-Pond-Clark, 2181 E Foothill Blvd, Pasadena 8, Calif.

(*Continued on page* 158)

Cooling Tower Fan

445 • Class 7000 fans are furnished in two basic sizes: series 48, with 48-in. diameter hub, and series 72, with 72-in. diameter hub. They have any number of blades from 2 to 8, as dictated by performance requirements. Standard diameters up to 24 ft are available, with larger sizes on special order. The units are constructed of corrosion-resistant materials. Resilient blade mounting simulates a hinged joint, eliminates bending stresses at root of the blade. Units operating at design pitch are said to provide uniform velocity from hub to tip.

Moore Co, Marceline, Mo.

Transmission Belt

440 • New rubber transmission belt made with all rayon fabric is said to be 25% stronger and have up to ten times greater flex life than cotton fabric belts made with the same number of plies. Because the rayon plies are 30% thinner than cotton plies, manufacturer claims they flex easier over small diameter pulleys and more plies can be used.

Drivesall rayon fabric belt is designed for use on medium-duty drives for fans, blowers, air compressors, pumps, machine tools, mills, and special machinery.

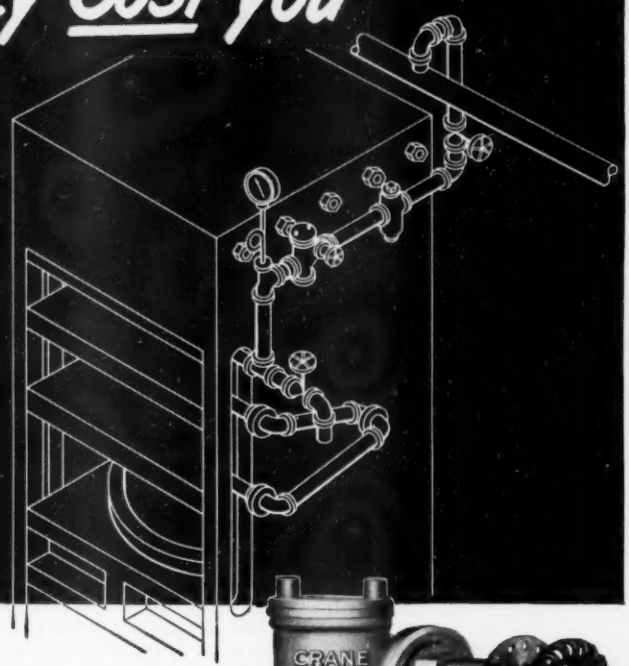
B F Goodrich Co, Akron, Ohio.

It's not what you Pay for Valves . . . it's what they Cost you

on Steam Heated Machinery

for example

(A Case History)



Crane No. 960 Brass Pressure Regulator, for steam or air, up to 250 psi. See your Crane Catalog.

What you pay for valves is not the final criterion of value. Not when maintenance can quickly equal or exceed purchase price. A thrifty buyer knows his maintenance; knows also there's bigger value in better quality.

Take the case at Dryden Rubber Division of Sheller Mfg. Corp., Chicago. More than 25 years ago, this plant started using Crane Pressure Regulators on steam lines to molding presses. 225 are in service today; many still are the original installations, still working faithfully. The records for all Crane regulators, regardless of age, show no maintenance cost other than prescribed periodic routine servicing.

Today, more than ever, you need greater assurance of quality in piping materials. You get it in Crane Valves—the recognized standard of quality with thrifty buyers everywhere. Your big Crane Catalog offers complete selections for all needs. Your Crane Representative is always ready to serve you.

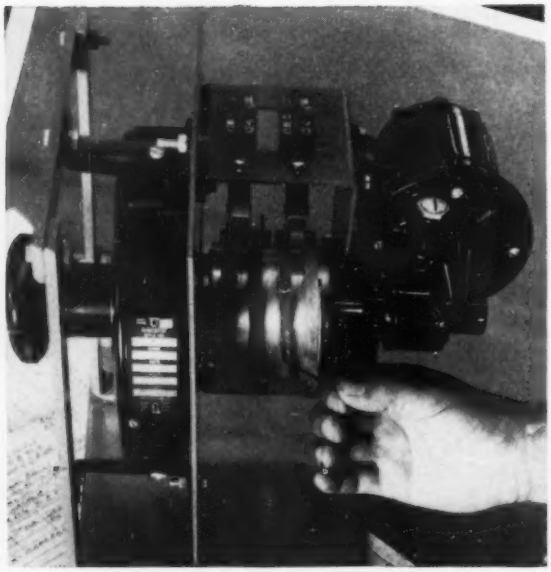
CRANE VALVES

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas.

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

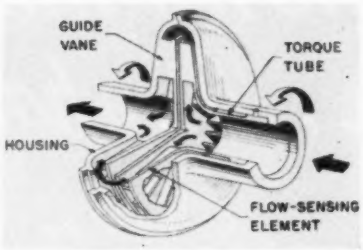
More EQUIPMENT NEWS

Begins on page 156



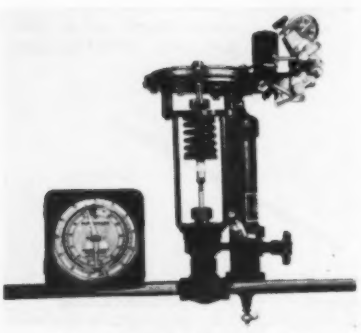
Motor-Operated Field Rheostat

414 • New motor-operated field rheostat adjusts speed of d-c motors up to 200 hp size and voltage of generators up to 300 kw. RK rheostat uses snap-action limit switches. Two cam-operated switches are supplied with each unit with additional switches available for auxiliary circuits. Each cam is adjustable over a 360 degree range from the front of the rheostat, and is available for 15-, 45-, and 90-degree travel. Two different gear ratios can be supplied: one permits full rheostat travel in from 5 to 15 seconds; the other permits full travel in 15 to 45 seconds. Travel time can be adjusted over a 3 to 1 range by inserting resistance in the motor circuit. Drive mechanism mounts on the front panel, up to three standard rheostat plates can be mounted on rear of panel, and all components are readily accessible for inspection or adjustment.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



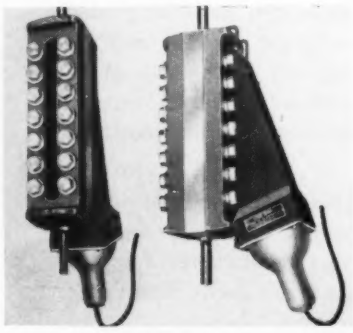
Mass Flowmeter

403 • New instrument measures the true mass rate of flow of anything that will flow or fall through a pipe. Meter responds only to pounds and is totally insensitive to volume. Direct reading measurements in terms of pounds per minute, or with integration, pounds, can be made on gases, liquids, slurries, or particles in an air stream, all with the same instrument. Measurement is independent of volume, temperature, pressure, viscosity, compressibility, or external accelerations. Applications include proportioning control, direct weighing control. Unit measures torque necessary to give the flowing mass a Coriolis acceleration. This torque depends only on dimensions of the flowmeter, rotational speed, and the mass flow so that all the usual volumetric troubles are eliminated. Until flow rates and sizes can be standardized, the new mass meter will be custom built. The most vital industrial and military needs will be met first.
Control Engineering Corp, Norwood 59, Mass.



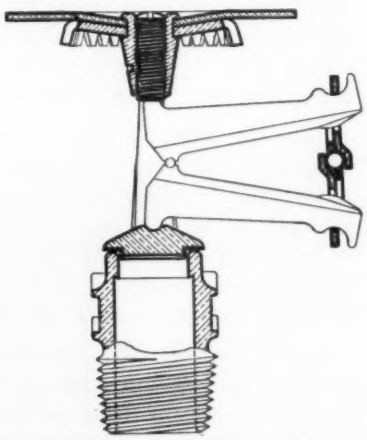
Blowdown Control Valve

428 • Valve permits completely automatic control of boiler blowdown operations. Unit has automatic cycle-timer, can be adapted to all types of industrial boilers.
Rice Industries, 24 Clearview Dr, Pittsburgh 5, Pa.



Gage Illuminator

446 • Type M illuminator uses a 100-w sealed-in beam mercury vapor lamp as its source of light. Brilliant greenish-blue light makes meniscus at water level shine brightly over entire length of visibility of the gage. Complete unit consists of the illuminator shown plus a small ballast not shown. Ballast can be plugged into standard 120-v electrical system.
Yarnall-Waring Co, Phila. 18, Pa.



Improved Spray Sprinkler

435 • Automatic spray sprinkler is available in two styles—upright, for exposed piping installations, and pendant, for concealed piping. Discharge waterway and operating mechanisms are identical to previously approved sprinklers. But manufacturer claims modifications in frame design and deflector afford more efficient use of water for fire protection.
Automatic Sprinkler Corp of America, Youngstown, Ohio.

(*Continued on page* 160)

For more data on these items, use post cards p 165. Identify your request with item number.

View, showing 16 cells of new Foster Wheeler cooling tower erected on foundation of old tower. Portion of old tower, shown at right, was replaced by 8 cells of new tower.

Tailored to fit customer plant conditions!

THE ERECTION of this new 24-cell cooling tower on the same foundation as the 56-cell tower which required replacement, without interruption in cooling capacity, is another example of the ability of Foster Wheeler to tailor the job to conditions in the customer's plant.

To assure a continuous supply of cooling water while the new tower was being built, 30 cells of the old tower were razed and the remaining 26 cells connected to two smaller existing towers by a temporary flume. The first 16 cells of the new tower were then erected and put into operation in time to meet the oncoming summer heat load. The remainder of the old tower was then removed and the balance of eight new cells erected.

It is through such unusual types of installations that Foster Wheeler has gained the reputation for engineering and construction excellence.

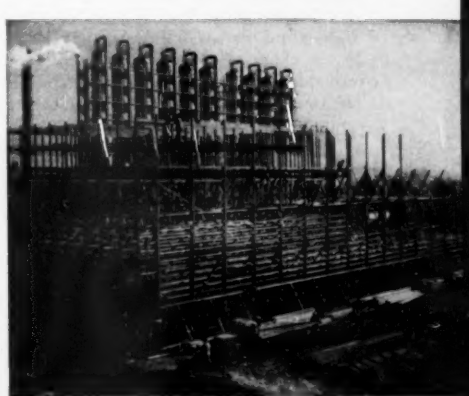
FEATURES OF THIS INSTALLATION:

Combination cast iron and red brass distribution system, with 720 special full coverage red brass up-spray nozzles, provides uniform water distribution over a wide variation in water flow rates. Induced-draft fans with 16-foot stacks discharge tower vapors at a high velocity 60 ft. above basin curb—reducing recirculation to a minimum.

The new tower requires 4320 sq. ft. less ground area than the old tower—enough to allow for the addition of four 30 ft. by 36 ft. cells for future requirements.

DESIGN CONDITIONS

Capacity	48,000 U.S. gpm
Inlet water temperature	120° F
Outlet water temperature	85° F
Wet bulb temperature	80° F

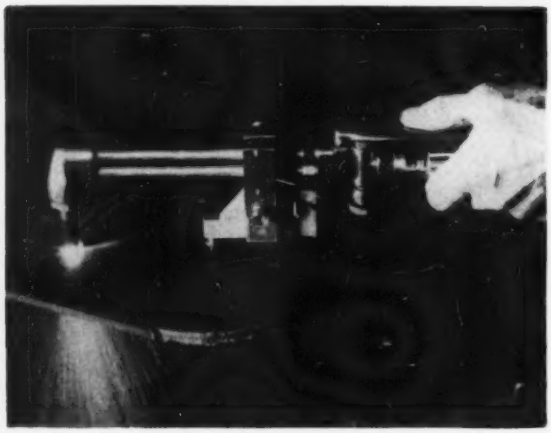


FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, NEW YORK

FOSTER WHEELER

More EQUIPMENT NEWS

Begins on page 156



Metal Cutting Guides

419 • Series of new, precision type cutting guides for individual gas-flame metal-cutting torches provide the workman with simple, low-cost attachments for cutting circles, straight lines, bevels, and sundry shapes. Made in styles to fit all makes of torches (from 70 to 90 degree models), the guides are of three principal types: a small circle guide (1 to 15 in. dia), a large circle guide (10 to 66 in. dia), straight-line guide for straight and 60 or 45 degree bevel cutting. Guides can be attached to torches in 2 or 3 minutes; finger-tip adjustments need no tools.

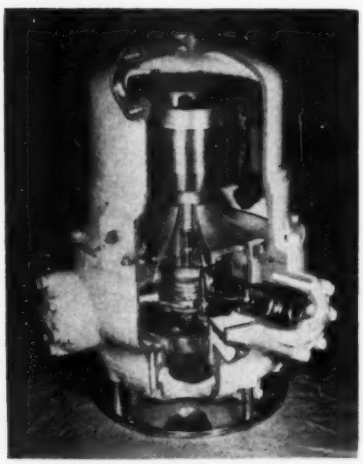
New Era Engineering Co, Dept G-23, 458 W 29th St, Chicago 16, Ill.

Quick-Opening Manway

413 • Welding lugs on frame of new manway match similar lugs on the cover. Cover is joined to frame by two free-fit pins held by cotters. Both pins are freely removable from the locking position; either pin may be withdrawn, the other supports the cover.

Manual effort gives a tight seal. Frame has a smooth internal recess and protective lip with a molded gasket. The cover registers with frame recess, compressing the gasket. Further loading by the pressure in the vessel provides a positive seal. Gasket is not cemented, is quickly replaced, and is protected from damage by the recess. Available in four frame styles with 16, 18, 20, 24 and 30 in. ID's in service ratings of 150, 300, 400, and 500 psi. "O" ring seal available for vacuum service.

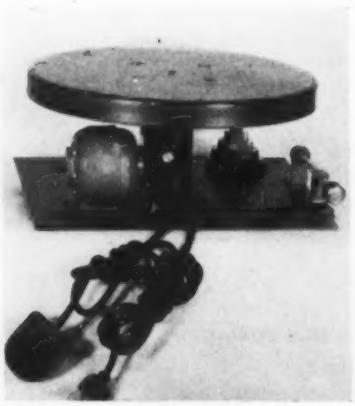
Lenape Hydraulic Pressing and Forging Co, West Chester, Pa.



Hermetic Compressor

404 • New Trane accessible hermetic compressor will be built in 5- and 7½-ton rate capacities using Freon-22 refrigerant and 3-ton capacity using Freon-12. It is designed especially for self-contained air conditioners. Unit combines the advantages of hermetic construction with accessibility of valves, strainer and lubricants, according to the manufacturer.

Trane Co, La Crosse, Wis.



Work Positioner

406 • Electrically turned, variable-speed work positioner is offered in both bench and pedestal models, can be inclined or operated intermittently. Unit is easily portable. Without the pedestal it weighs 31 lb, is 5½ in. high and covers 20x18 in. The turntable has 15½-in. diameter. It safely carries a work load of 300 lb and moves it continuously or intermittently at speeds adjustable upward from ¼ rpm. Unit feeds off any 110-v 60-cycle plug.

All-State Welding Alloys Co, Inc, 249 Ferris Ave, White Plains, N. Y.

Ac Welder

442 • Redesigned 300-amp ac welding transformer features stepless current selection from 40 to 375 amps. The welder is useful for practically all applications from light-duty, low-current sheet metal work to heavier-duty, high-current industrial jobs. It incorporates an enlarged scale and finely threaded screw adjustment for current selection. Electrodes can be from 3/32 to ¼ in. diameter.

High-temperature coils are protected by silicone insulation and ventilated by a forced-draft fan rated for continuous duty. Unit is 36 in. high, 21 in. diameter, weighs approximately 328 lbs.

General Electric Co, Schenectady 5, N. Y.

Solderless Terminals

402 • Flag type heavy-duty solderless terminals are available for eight wire sizes from 8 to 4/0. Tongues are designed for a wide range of stud sizes. Terminals are made of pure copper, electro-tinned for maximum conductivity and surface protection. They can be used with solid, stranded, or irregularly shaped wires or combinations of these types.

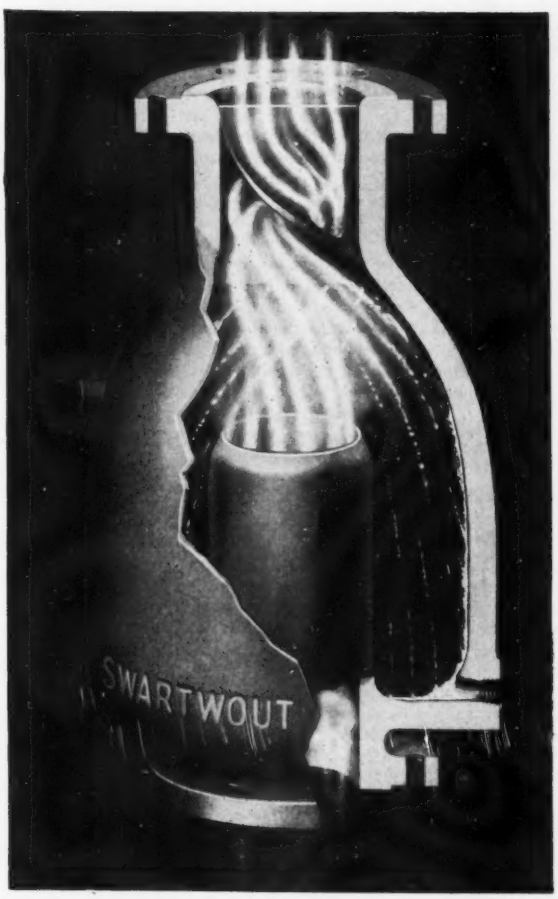
Aircraft-Marine Products, Inc, 2100 Paxton St, Harrisburg, Pa.

(*Continued on page* 162)

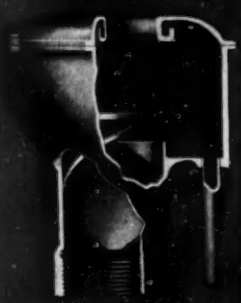
For more data on these items, use post cards, p 165. Identify your request with item number.

Swartwout Separators remove over 99% of all entrained matter—virtually without pressure drop

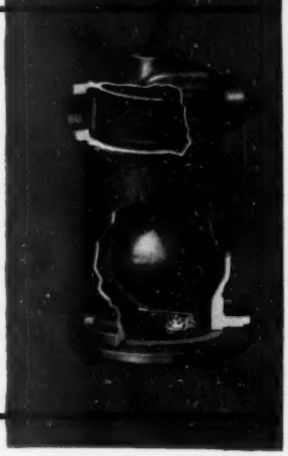
1 IN SWARTWOUT helico-centrifugal separators, the whirl does the trick . . . assures *positive removal of unwanted elements virtually without pressure loss.* Exclusive helix, located at separator inlet, imparts high-speed whirling motion to steam that efficiently removes entrained liquids, solids, oil or grease from live or exhaust steam, from air or chemical vapors under pressure or vacuum. And Swartwout separators have no plates, baffles, screens or grids to cause pressure drop, flow reversal, changes in velocity head, vibration or noise. Vertical separators for up-flow or down-flow; in 50 to 600 lb. standards. See Bulletin S-14-C.



2 HORIZONTAL SEPARATORS, built on helico-centrifugal principle, handle any sort of separation with a maximum pressure loss of only a few inches of water under high pressures or under vacuum. Cast iron for 50 to 250 lb. standards; cast steel for 150 to 600 lb. standards. See Bulletin S-14-C.



3 EXHAUST HEADS, using same helico-centrifugal principle as Swartwout separators, remove moisture and oil from exhaust steam . . . prevent rotting of plant roofs and walls in warm weather and ice formation in winter. For exhaust pipes from 1 to 30 inches in diameter. See Bulletin S-16-C.



4 SWARTWOUT AIRFUGE air separators remove impurities by centrifugal force. Simple, float-operated trap releases accumulated liquids automatically while maintaining level sufficient to effect seal. No maintenance required except occasional blowdown. See Airfuge Bulletin S-13.

A-4500

Swartwout

POWER PLANT EQUIPMENT
PROCESS INDUSTRY CONTROLS
INDUSTRIAL VENTILATION

SEND FOR BULLETINS S-14-C, S-16-C, S-13 · THE SWARTWOUT COMPANY · 18511 EUCLID AVENUE · CLEVELAND 12, OHIO

More EQUIPMENT NEWS

Begins on page 156

Constant Support Hanger

417 • Model R hangers permit 10% increase or 10% decrease in their load by field adjustment of a single bolt, without impairing their constancy. Hangers are smaller, require less head room, can be bolted directly to the building structure. Frames are drilled for either single or double rod suspension. Three regular frame sizes provide maximum travels of 4, 8 and 12 in. and will take care of all loads from 48 to 9304 lb. Ratios between spring force and supported load range from 1.15 to 1 minimum and 4 to 1 maximum. Each hanger is individually calibrated before shipment.

Grinnell Co, Inc, 260 W Exchange St, Providence 1, R. I.

Rotary Shaft Seal

412 • *John Crane* type 19 seal is said to provide life-time performance in small pumps, hot water circulators, etc. Special beveled cones made of *Teflon* are used as the flexible member. Seal can be used for water, oil, corrosives or acids; temperatures from −100 to +450 F; vacuums and pressures to 200 psi; and high shaft speeds. Available to fit shaft diameters of ¼, ⅜, ½, ⅝ and ¾ in. Bronze, stainless steel, etc, construction can be specified to meet service requirements.

Crane Packing Co, Dept P-29, 1800 Cuyler Ave, Chicago 13, Ill.

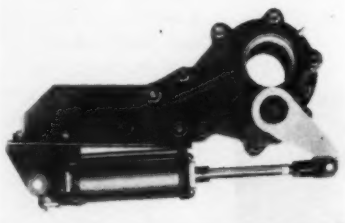
For more data on these items, use post cards, p 165. Identify your request with item number.

Self-Tightening Valve

453 • *Harper-Velan* self-tightening valve has a combination seal and seat disc. The disc is pressure loaded on the differential area when valve is closed; it also permits a slight downward movement during closing action. If the seat is closed and valve cools off, seat ring automatically follows the valve disc to compensate repeated temperature variations. Seat and disc are reversible, the unused portion of the disc being held in reserve and protected against wear.

All parts subject to wear can be replaced without removing valve from line and no special tools are required. The same valve can be used as a straight-way or angle type. Signalling device indicates if valve is closed or open.

Velan Engineering Co, 1 Exchange Place, Jersey City, N. J.



Quick-Acting Valves

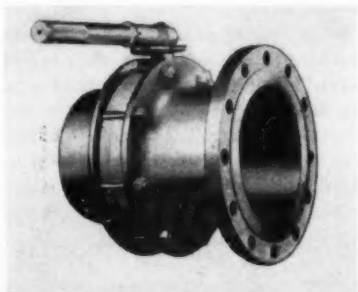
410 • New cylinder-operated quick-acting valves may be actuated by air or other fluid, can be regulated for operation at any speed, and also remote controlled electrically or manually. The valves permit automatic cycle operation and multiple operation by one man, and their power control eliminates operator fatigue.

Units have straight-through flow and drop tight seal, are applicable wherever quick opening and closing is desired.

Everlasting Valve Co, 49 Fisk St, Jersey City 5, N. J.

CHECK THESE TOO! . . .

Spark-Fired Gas Engine . . . . . p 170
Variable Speed Drive . . . . . p 172
Spacer-Type Coupling . . . . . p 174
Telephone Type Relays . . . . . p 176
Magnetic Starters . . . . . p 178
Slack-Tube Manometer . . . . . p 180
Submersible Cellar Drainer . . . . p 182
Packless Valve . . . . . p 186
One-Man Fire Engine . . . . . p 188



Butterfly Valve

426 • Butterfly valve is recommended for use in liquid, sludge or dry material lines. The disk of the valve rests on a resilient, oil and acid-resistant seat and will provide a complete shut-off against pressures up to 150 psi, or against vacuum.

Seat, disk and handle can be removed for inspection, cleaning or replacement without disconnecting the line. Handle mechanism is indexed to hold the valve in full open or fully closed position. Valve is manufactured in sizes from 2 through 12 in.; any combination of threaded, flanged or welding end connections can be furnished. Bodies and disks can be supplied of steel, bronze, aluminum or other alloys as required.

Keystone Tool Corp, 5325 Kirby Dr, Houston, Texas.

Cycle Control Valve

454 • *Cycloflow* valve is primarily designed for controlling cycles of flow in ion-exchange equipment. It eliminates possibility of contaminating leakage by providing an isolated section connection to waste between the outlet and sources of contamination.

Valve can be manually or automatically operated. Four double-acting pistons give positive valve action, actuated by simple, integral fingertip control. Design eliminates spring loading and large unbalanced areas and flat surfaces. It can be completely disassembled with a pocket wrench in 15-20 minutes without removing piping connections.

American Water Softener Co, 330 W Lehigh Ave, Philadelphia 33, Pa.

Electrode Holder

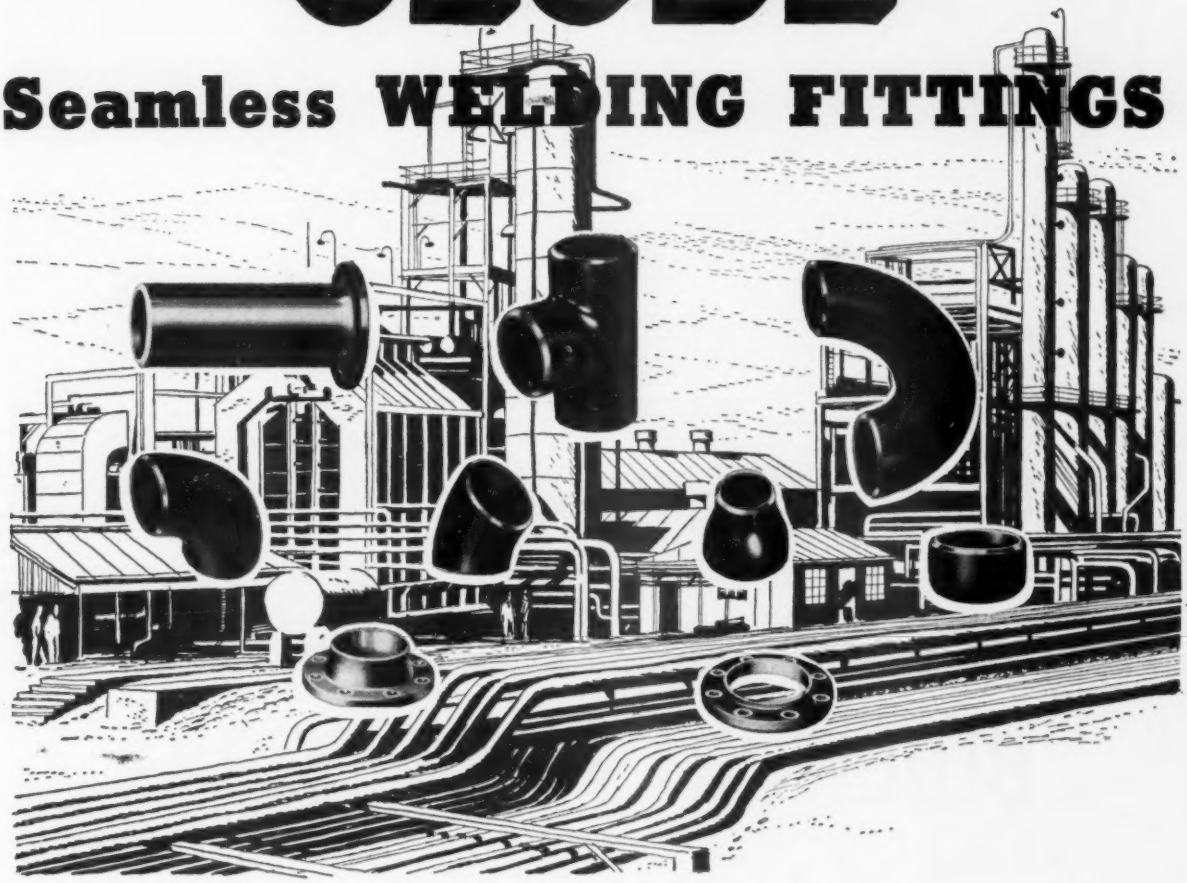
427 • *Cooltong* 400-amp insulated electrode holder has nose made in special "sandwich" construction—copper core between four and six layers of laminated, glass impregnated, plastic cloth. Jaws are made of *Mallory 3* metal, non-spatter type. They will handle electrodes from ⅛ to 5/16 in., have a wide opening to permit fast release of stubs. Current carrying frame parts are copper reinforced with steel. Copper sheathing protects insulating part from heat and spatter and keeps holder cooler by carrying away heat. Holder handle is perforated for ventilation, is unbreakable and easy to hold in any position.

Lincoln Electric Co, Cleveland 17, Ohio.

(Continued on page 170)

GLOBE

Seamless WELDING FITTINGS



The only seamless welding fittings precision-processed . . . from billet . . . to tube . . . to fitting

From charging the specially designed revolving furnace with a steel billet (above) through the many succeeding steps of production, every Globe process is specialized to produce fittings of unvarying quality.

Globe precision-process manufacture begins with the billet —continues through the making of the seamless steel tube (Globe alone among welding fittings manufacturers produces seamless steel tubes)—and extends through to the production of the finished fittings.

Because Globe has highly specialized controls—at every stage of manufacture at its own plant—you can be sure of uniform high quality seamless welding fittings when you specify Globe.

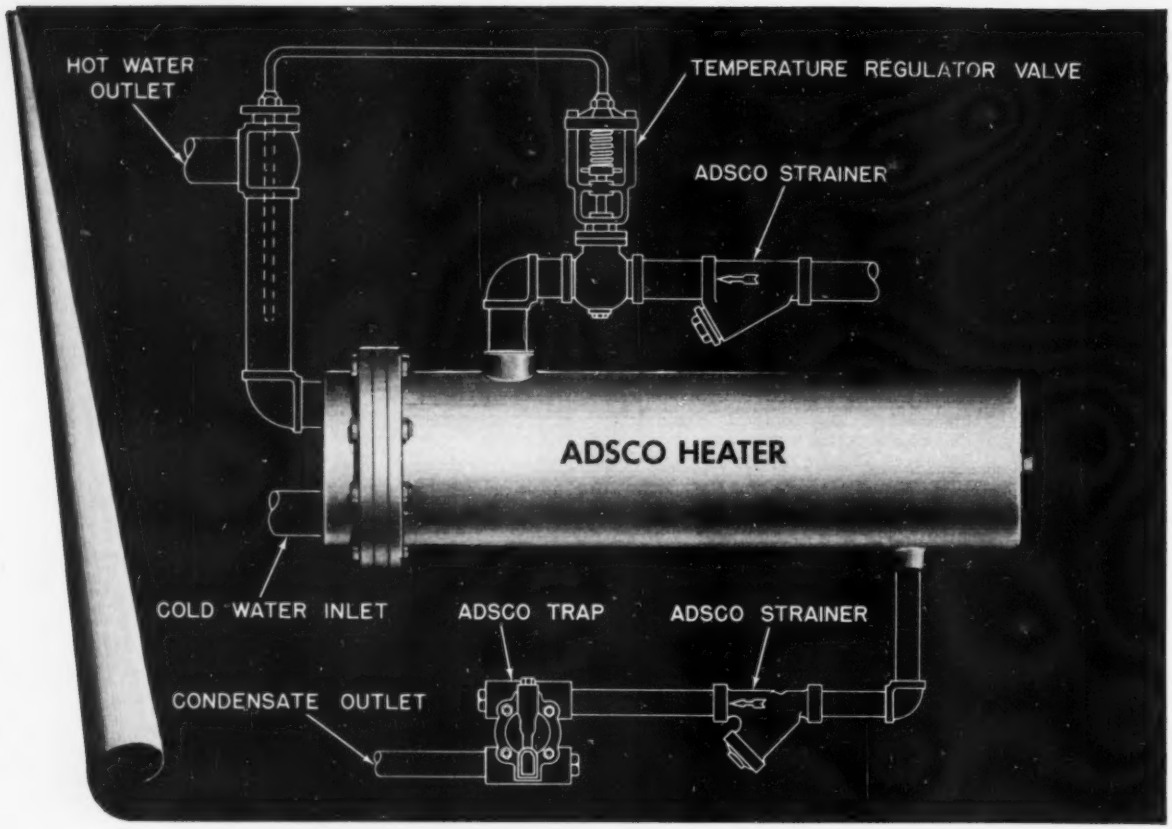
Send for the Globe Welding Fittings complete catalog.

GLOBE STEEL TUBES CO.,
Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis • Denver • Houston • San Francisco
Glendale, Cal.

Producers of Globe Welding Fittings — Globe seamless stainless steel tubes — alloy-carbon seamless steel tubes — Gloweld welded stainless steel tubes — Globeiron (high purity ingot iron) seamless tubes.

AVAILABLE IN A COMPLETE LINE OF SIZES AND WEIGHTS THROUGH GLOBE DISTRIBUTORS IN ALL KEY CITIES



BLUEPRINT FOR ACTION!

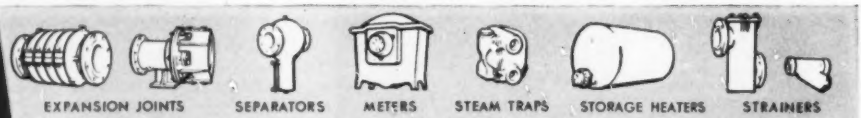
And what action, when you use an ADSCO Water Heater! Hot water . . . when and where you want it . . . and at low cost! ADSCO Instantaneous Heaters furnish industry with general service hot water, boiler feed water, and process water. They supply hotels, apartments, office buildings, dormitories, hospitals, and institutions with hot water for showers, washrooms, dishwashers, laundries, and for general cleaning. ADSCO Convertors, a type of instantaneous heater with a shorter temperature range, furnish *all types* of buildings with hot water for quiet, trouble-free space heating systems.

Yes, you get plenty of action — fast action — out of ADSCO Water Heaters. They operate best when connected according to the typical piping arrangement shown above, with two ADSCO Y-type Strainers to protect valuable equipment and an ADSCO Dual Steam Trap to handle condensate efficiently.

ADSCO Water Heaters have only three parts: shell, tube bundle, and cover. All are made to ADSCO's high standards. Steel shells are seamless steel pipe, carefully cut and welded by skilled workmen. The shell flange is sturdy and accurately machined and all openings are precisely located. The tube bundles are made of pure, deoxidized seamless copper tubes formed into U-bends. By means of electrically and automatically controlled equipment, they are rolled and expanded into carefully drilled tube sheets which have a diamond pitch arrangement for spacing of tubes. The semi-steel covers are high-tensile, fine-grain castings.

For further information, write for Bulletin 35-78 on Instantaneous Heaters or Bulletin 35-77 on Convertors.

ADSCO ENGINEERED PRODUCTS



AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

Want quick direct-from-manufacturer service?

USE THESE CARDS

- First check what you need: more information on a new product or an ad, copies of free catalogs, bulletins
- Then describe the product, or literature desired. Give model numbers, bulletin numbers wherever you can
- Be sure to write in number of page on which item appeared, and issue of POWER in which you spotted it
- Finally, address reverse side of card to the manufacturer concerned

If you like this quick, direct-to-manufacturer service, we'll gladly send you a supply of cards

PLACE 2¢ STAMP HERE

Reader Service Department
POWER
330 West 42nd Street
New York 36, N. Y.

I want details on these New Products... 4/53

☐ ☐ ☐ ☐ ☐ ☐

Send me these FREE Catalogs and Bulletins...

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

My Name.....
Please print
Title.....
Company.....
Street Address.....
City, State.....

Please use before August 1, 1953. Void after this date.

GENTLEMEN: Please send me, without obligation, further information on the following: *(Check one and describe)*

☐ NEW PRODUCT ☐ ADVERTISEMENT ☐ LITERATURE

_____
Describe item here

_____

It appeared on page_____of the_____issue of POWER.

My Name .....
Please print
Title .....
Company .....
Street Address .....
City, State .....

PLACE 2¢ STAMP HERE

TO:

.....
Manufacturer's name

.....
Street address

.....
City, State

I want details on these New Products... 4/53

☐ ☐ ☐ ☐ ☐ ☐

Send me these FREE Catalogs and Bulletins...

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

My Name.....
Please print

Title.....

Company.....

Street Address.....

City, State.....

Please use before August 1, 1953. Void after this date.

PLACE 2¢ STAMP HERE

Reader Service Department
POWER
330 West 42nd Street
New York 36, N. Y.

PLACE 2¢ STAMP HERE

TO:

.....
Manufacturer's name

.....
Street address

.....
City, State

GENTLEMEN: Please send me, without obligation, further information on the following: *(Check one and describe)*

☐ NEW PRODUCT ☐ ADVERTISEMENT ☐ LITERATURE

_____
Describe item here

_____

It appeared on page_____of the_____issue of POWER.

My Name .....
Please print

Title .....

Company .....

Street Address .....

City, State .....

This month's FREE Literature

AIR CONDITIONING, HEATING REFRIGERATION, VENTILATION

1 **RADIANT PANELS** — far-infrared, suitable for heavy-duty industrial heating, drying and curing operations. Bulletin L-1093, 4 pages. Edwin L Wiegand Co, 7731 Thomas Blvd, Pittsburgh 8, Pa.

2 **BUILDING EQUIPMENT** — revised catalog covers equipment for air conditioning, refrigeration, engines, deaerators, water conditioning, turbines and pumps. 20 pages, Bulletin WP-1099-B27M 529 SC. Advertising Dept, Worthington Corp, Harrison, N. J.

3 **VENTILATING FANS**—V-belt driven, packaged units for volumes from 100 to 12,000 cfm at low static pressures. 28 pages, Catalog 515. Clarage Fan Co, Kalamazoo, Mich.

BOILERS AND ACCESSORIES

4 **COAL SCREW-CONVEYOR**—from pile or bin to hoppers, Y assembly for two hoppers, horizontal crossfeed unit for three or more. 4 pages. Canton Stoker Corp, Andrew Place S.W., Canton, Ohio.

5 **DUST COLLECTORS**—efficiency curves, arrangements, dimensions, flue-gas density tables and nomograph for calculating required tubes. 8 pages. Prat-Daniel Corp, 2 Meadow St, South Norwalk, Conn.

6 **BOILERS**—"80" series for small apartments, commercial buildings, large homes; "D" type for large buildings. Fitzgibbons Boiler Co, Inc, 101 Park Ave, New York 17, N. Y.

7 **BOILER CONTROL** — includes combustion, feed water, boiler steam temperature and soot blower controls. Taylor Instrumentation. 10 pages, Bulletin 1007. Copes-Vulcan Div, Erie 4, Pa.

8 **STEAM BOILER UNITS**—packaged, automatic, oil or gas or combination, high and low pressure, low pressure heating. Bulletins 508, 509, 9100, 510. Johnston Brothers, Inc, Ferrysburg, Mich.

10 **FLAME FAILURE SAFEGUARDS**—for all combustion installations, using oil, coal or gas. Bulletin 523, 4 pages. Ess Instrument Co, 96 S Washington Ave, Bergenfield, N. J.

ELECTRICAL AND MECHANICAL CONTROLS

11 **AUTOMATIC STATIC ALARM SYSTEM**—complete plant-wide installation prepared by the Naval Ammunition Depot, Crane, Ind. The John Hewson Co, 106 Water St, New York 5, N. Y.

12 **TEMPERATURE MEASUREMENT AND CONTROL**—manual defines and distinguishes between types making easier selection of system. Bulletin 101, 24 pages. The Partlow Corp, New Hartford, N. Y.

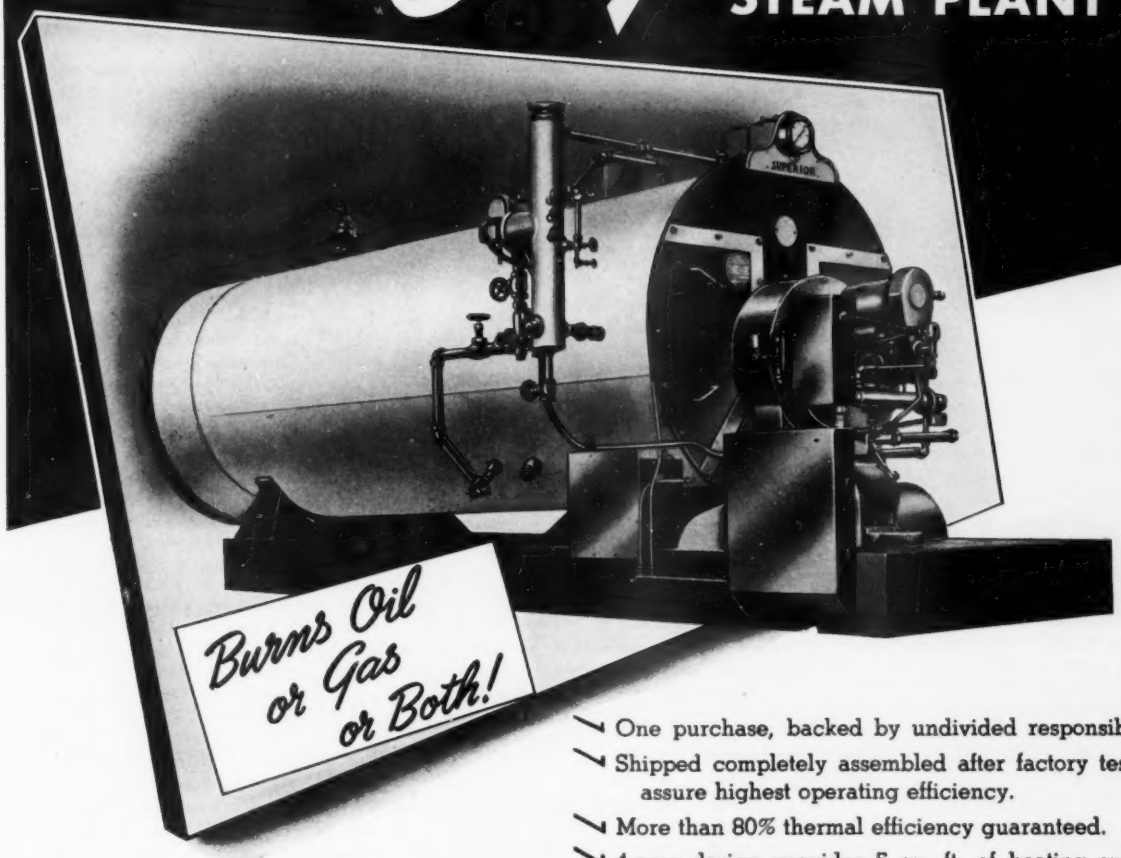
13 **THERMISTORS**—includes gas analysis cells, combustion analyzers, temperature sensing devices, and electronic and thermal control instruments. Data Book. Victory Engrg Corp, Springfield Road, Union, N. J.

14 **MULTI-UNIT CONTROL CENTERS**—centralized control for multi-motored machines or a large group of machines. 28 pages, Bulletin 798. Allen-Bradley Co, 136 W Greenfield Ave, Milwaukee 4, Wis.

15 **CIRCULAR CASE CONTROLLERS**—for automatic control of temperature and pressure, with on-off or proportional control action. 16 pages, Bulletin 465. The Foxboro Co, Foxboro, Mass.

(Continued on page 230)

HERE'S YOUR *Complete* STEAM PLANT



- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
- For complete details, write today for catalog **500.**

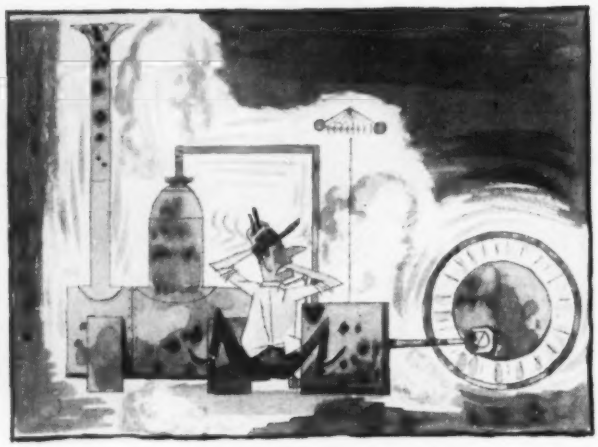
SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES, Inc.

Factory: Emmaus, Pa.

Executive Offices: Times Building, Times Square, New York 18, N. Y.

George Edwards' Scrapbook



"Average energy received from the sun by each acre of land in the U.S. per year is equivalent to 800 tons of coal, or about 2¼ tons each day," said Charles L McCuen, GE vice-president. "We have made only feeble attempts to utilize this tremendous source of free fuel. Green leaves grow all around us. Nature uses her method to extract energy from the sun. Some day man will discover nature's secret and we won't have to mine or drill for oil."

I won't hurry to scrap my coal stokers after reading this, but if we should succeed in piping the sun's energy into boilers in my lifetime, I'll feel mighty silly every time I think of all the coal I shoveled in my younger days.

American pipeliners are pushing a scheme to build a gas main over 2500 miles long. Start is near the Red Sea. Then it passes through African deserts, dives under the Straits of Gibraltar, runs up through Spain, over the Pyrenees mountains into France, goes under English Channel to London. Branches would supply Paris, Madrid and hundreds of other cities.

Where's the young engineer who cries about lost frontiers just because our railroads and many other industries are pretty well established? Talk about problems and opportunities with such a pipeline job! Kinda makes me wish I was just starting out.

Subscriber Art Belton of Canada sends a newspaper clipping about Eric Davidson, the blind auto mechanic. Davidson was blinded in 1917 at age of 2½ when a French munitions ship blew up in Halifax, blinding 300 persons with flying glass. Davidson is not only an expert auto mechanic, but he can recognize any car, even old-timers, by the sound of the horn. If stumped, he feels a car, and soon door handles, grill designs or hub caps give it away. He learned his trade by tearing down old cars—while his brothers read manuals to him so he understood parts he held in his hands, learned what they were for.

Reading this makes me feel mighty useless when I remember some of the things I've complained about while doing maintenance work.

Air-conditioning division of Mitchell Mfg Co, says "tests in a large Midwestern university showed that students suffered a 40% average drop in mental efficiency during hot and humid summer months."

Good thing I didn't know that years ago when I worked over No. 2 boiler for two hours in my shorts, with the thermometer reading 140 F while I repaired that burned-out bearing on the induced-draft fan. Next morning the Chief told me that I broke all records for that kind of repair. And I told him I HAD to or I'd have been roasted alive.

Ran across the Rules and Regulations of the Amasa Whitney Mills in Winchendon, Mass., dated July 5, 1830. Rule 1 says the mill opens 10 min before sunrise (all seasons). Gate closes 10 min past sunset from 20th March to 20th Sept—at 8:30 pm from 20th Sept to 20th March. Saturdays, gate closes at sunset. Rule 5 says, "Lost time must be made up before being paid." Rule 15 says, "25 minutes allowed for breakfast, 30 minutes for dinner, 25 minutes for supper."

I'm just passing this one along for those of us who like to talk about the "good old days."

"The fellow who knows 'how' will always have a job, and the fellow who knows 'why' will always be his boss," said R E Moore, vice-president of Bell & Gossett Co, speaking at the University of Illinois.

To this I add that the fellow who knows both "how" and "why" will always own the firm they work for—or at least he should.

"It is well for a man to respect his own vocation whatever it is, and to think himself bound to uphold it, and to claim for it the respect it deserves," said Charles Dickens over 100 years ago.

One way to gain respect as an operating engineer (says I) is for all of us (and the NAPE) to get behind a drive for a uniform license, good in all 48 states. Such a license must be administered so the examinations and experience required of the applicant are fair. Then we won't only be proud of our profession. Who knows? Some day we might even be paid as much as a registered plumber!

Looking through my old scrapbook, I found this one by Harriet Beecher Stowe: "When you get into a tight place and everything goes against you, till it seems as though you could not hold on a minute longer, never give up then, for that is just the place and time the tide will turn."

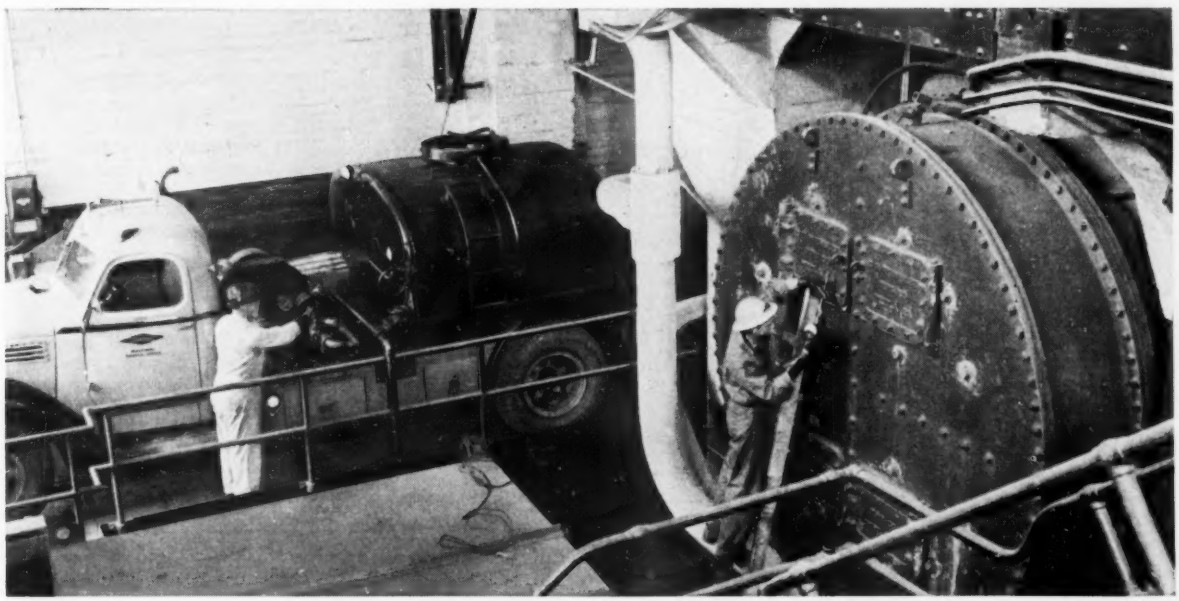
I guess Harriet never operated old Bessie, the unpredictable steam engine in the local gas works, when she wrote those lines. The only time I was ever in the tight spot she talks about was when Bessie started running away (no overspeed trip) and I tried to "hang on" to the throttle so the tide would turn, as she advises. Well, the tide turned all right, because that engine started shedding and soon she was scattered all over the engine room. And I was too—almost.

George Edwards

Engineer

CHEMICAL CLEANING SAVED 400 TONS OF COAL PER YEAR

Fly ash, soot and carbonate deposits removed from condenser by Dowell; vacuum increased



Fly ash and carbonate deposits on the water side of an 800-KW turbo surface condenser had reduced vacuum from a normal 28″ to 24″. The temperature of the water leaving the condenser had dropped from 95°F. to 85°F.

These deposits were removed by Dowell Service with specially prepared liquid solvents. Result: the condenser was restored to its normal operating efficiency. The steam requirement was reduced by 2.5 pounds per kilowatt hour. On the basis of 8,000 hours of yearly operation, the plant engineer calculated a saving of at least 400 tons of coal per year.

Dowell chemical cleaning methods can be used on hundreds of different kinds of industrial equipment. Engineers especially trained for this kind of work do the job for you. They apply solvents according to the technique demanded by the job: filling, spraying, jetting, cascading or vaporizing. Dowell liquid solvents can go wherever steam or water will flow, reaching places inaccessible to other cleaning methods. Scaffolding is unnecessary. Dismantling and downtime are kept to a minimum.

A call for Dowell Service will bring experienced personnel to your plant within a few hours with all necessary chemicals, pump trucks and control equipment. For complete information and estimates on the cleaning of your equipment, contact the nearest Dowell office, or write directly to Tulsa, Dept. D 23.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

2 Accelators®

DO A **BIG JOB** | IN A **SMALL SPACE!**

in a South American **DISTILLERY**

Two 44′ diameter Accelators treat 2800 gpm of Parana River water for clarification and color removal at a San Nicolas distillery in Buenos Aires. A portion of the treated water is used for boiler feed with supplementary treatment.

Elevated to provide gravity flow of clarified water to filters located over a clearwell, these Accelators provide water supply in a fraction of the space required by other types of water treating equipment.

Learn how the Accelator can solve your water treatment problem in *less* space at *lower* cost. Send for informative, illustrated bulletin (see coupon below).

INFILCO

INFILCO INC. | *Tucson, Arizona*

Plants in Chicago & Joliet, Illinois

FIELD OFFICES IN 26 PRINCIPAL CITIES

USEFUL INFORMATION FOR YOU →

INFILCO INC., Box 5033, Tucson, Arizona

Please send us your Accelator Bulletin 1825 K.

NAME_____

TITLE_____

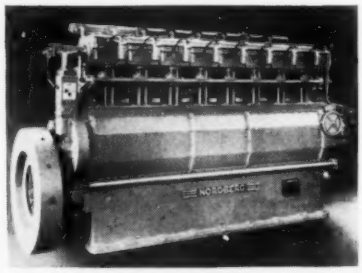
COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

More EQUIPMENT NEWS

Begins on p 156

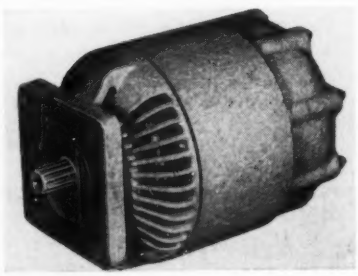


Spark-Fired Gas Engine

448 • New series of four-cycle, spark-fired gas engines, types FSE-9 and FSE-13, have 9 and 13 in. bore sizes, respectively. Available in non-supercharged, supercharged, intercooled-supercharged and *Supairthermal* types from 265 to 4260 hp. Both types burn natural gas, butane, propane, manufactured gas or sewage gas. Engines have same basic construction features as Nordberg 4-cycle diesel engines, and where gas is available seasonally they can be converted to fuel oil or duafuel operation. Manufacturer claims efficiency ranges from 38 to 41%. Expansion ratios reach 12½ to 1 and air-fuel ratios are controlled by variable inlet valve timing. Units are well-suited for pipe line pumping, industrial and municipal power plants, etc.

Nordberg Mfg Co, Milwaukee 1, Wis.

For more data on these items, use post cards p. 165. Identify your request with item number



Lightweight Aircraft Motor

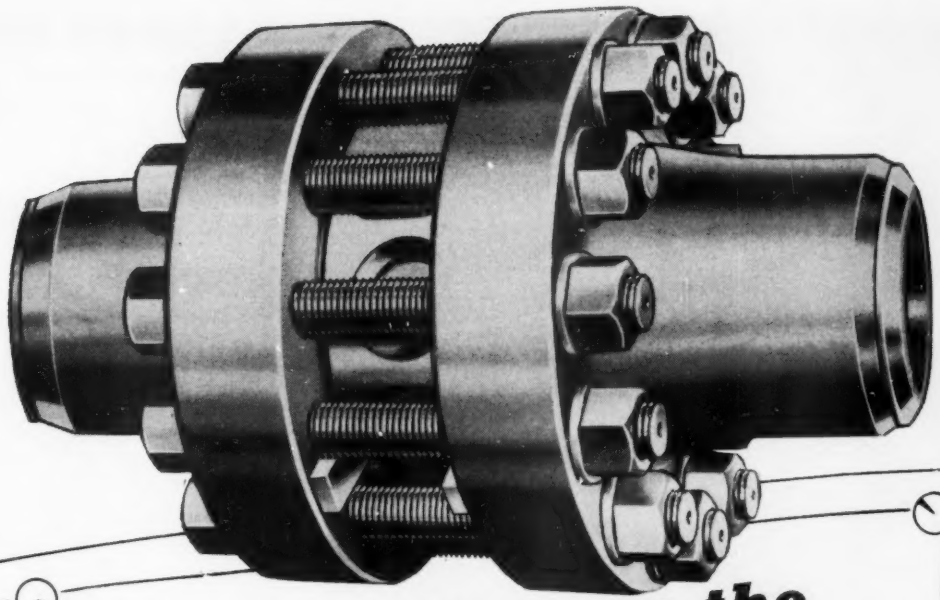
455 • New aircraft motor develops 10 hp for continuous duty, weighs 20¾ lb. Output shaft speeds available are 11,000 or 7300 rpm. Applications include control actuators, hoists, etc.

Unit operates on 400 cycle, 3-phase ac, has pre-packed ball bearings, splined take-off shaft.

U. S. Electrical Motors, Inc, Aircraft Div, Terminal Annex, Box 2058, Los Angeles 54, Calif.

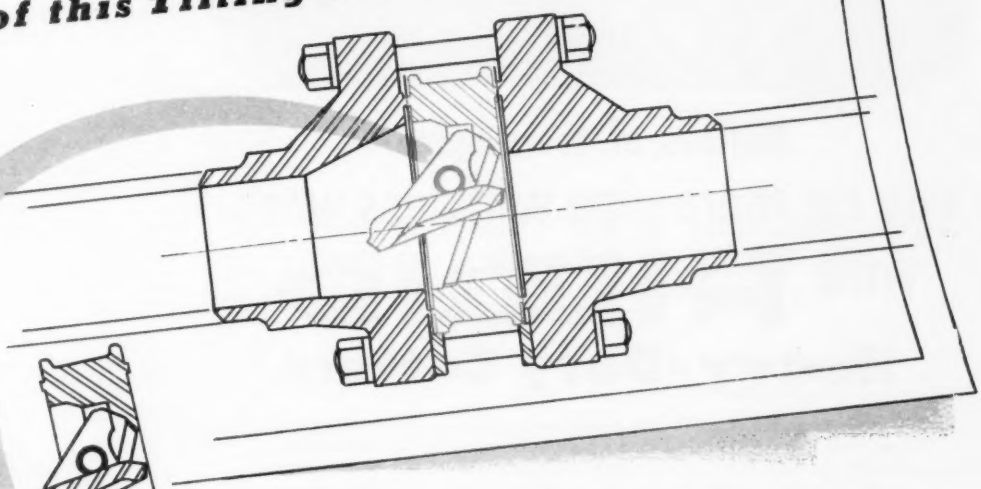
Pressure-Sensitive Label

401 • *Bind-X* label holder consists of a transparent plastic window, 1½ in. wide. Made in 6-in. lengths, it may be cut to any dimension needed. This window is backed by a strong reinforcement coated with a specially devised pressure-sensitive, latex adhesive. It adheres firmly to wood, leather,



You Can Remove the Center Section

of this Tilting Disc Check Valve



Just take out the studs between the inlet and outlet ends if repairs become necessary. Then the entire center section can be replaced . . . quickly and easily. No need to cut the valve out of a welded line.

The Tilting Disc Check Valve has the advantage of smooth, easy operation because of the balanced disc, which rides steadily and without fluttering in the flow through the lines. In closing, this disc is cushioned to a quiet, droptight seat . . . without any slamming under usual piping arrangements.

Chapman Tilting Disc Valves are also available in the standard two-piece design, in either iron or steel, for all pressures. Write for full details and prices to

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASS.

CHAPMAN 3-PIECE TILTING DISC **CHECK VALVES**

Millions of users agree—

you cut more pipe with less work with RIGID Heavy-Duty Cutters

There's a big difference in pipe cutters—and you're sure of it the first time you slap a RIGID on a pipe (any kind) and see how easily cleanly it rolls through the metal. Beautifully balanced for easy action. Factory tested for perfect tracking—and guaranteed warp-proof housings of special malleable hold it. High alloy thin-blade or heavy-duty cutter wheels that leave practically no burr. You cut pipe fast with least effort. Ask your Supply House for the more-for-your-money RIGID.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIGID
Work-Saver Pipe Tools

More EQUIPMENT NEWS

Begins on p 156

glass, metal, stone, paper, fiber, plastics, etc. User inserts a printed, type-written or hand-lettered label into the window. Labels are useful for stockroom or record systems.

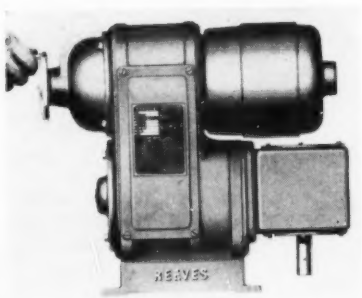
Cel-U-Dex Corp, 1 Main St, Brooklyn 1, N. Y.

Flexible Electrical Conduit

423 • Type UA conduit has tough, extruded synthetic covering over flexible metal core, protects wiring against moisture, oil, dirt, chemicals, and corrosive fumes. Conduit is made of spirally wound, interlocked zinc-plated steel strip with a copper bonding conductor wound spirally in the space between each convolution on the inside of the conduit. It has UL approval for use in wet locations. Available in long lengths in nominal electrical ID sizes ⅜ to 1¼ in. inclusive.

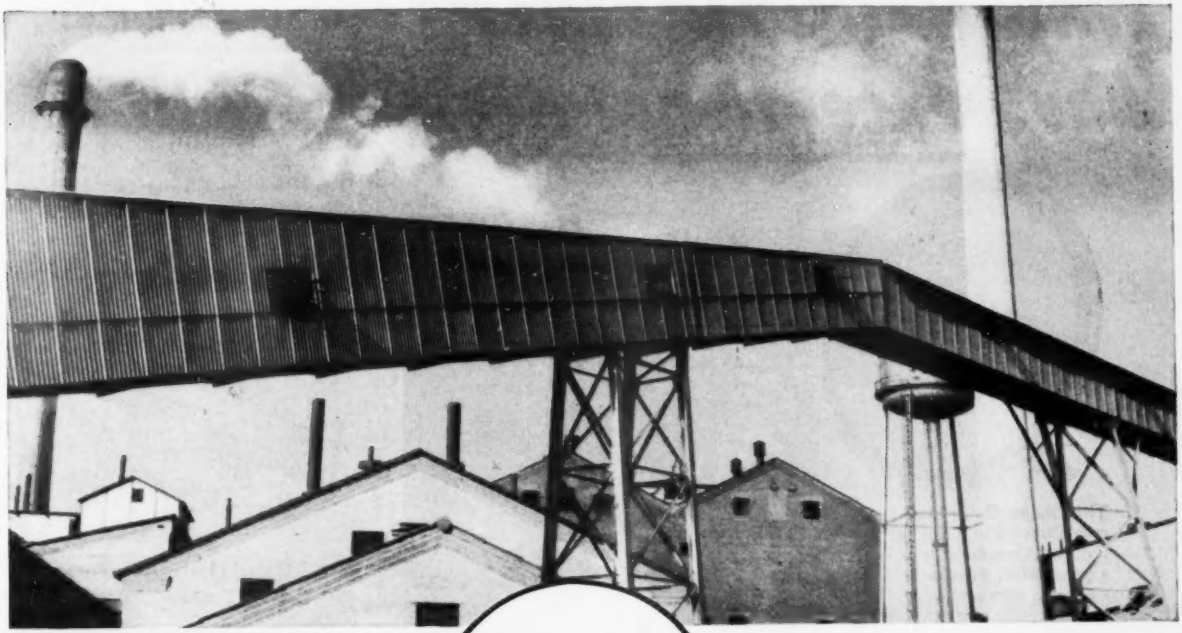
American Brass Co, 25 Broadway, New York 4, N. Y.

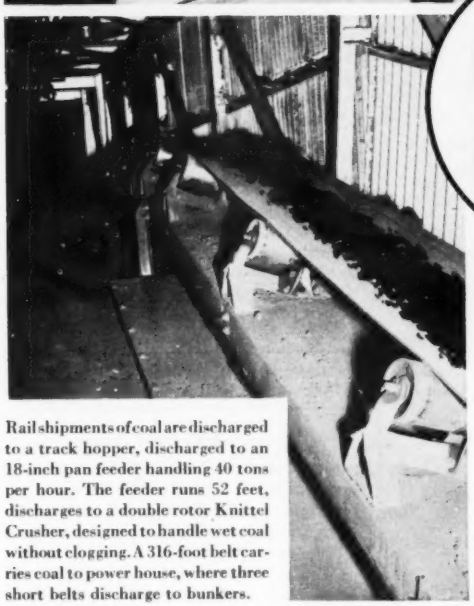
For more data on these items, use post cards p. 165. Identify your request with item number



Variable Speed Drive

456 • Fractional-hp varispeed *Motodrive* with right angle reducer combines in one unit any standard NEMA frame, type C face-mounted motor; Reeves speed-varying mechanism; and new right angle worm gear reducer. Available in horizontal or vertical





Rail shipments of coal are discharged to a track hopper, discharged to an 18-inch pan feeder handling 40 tons per hour. The feeder runs 52 feet, discharges to a double rotor Knittel Crusher, designed to handle wet coal without clogging. A 316-foot belt carries coal to power house, where three short belts discharge to bunkers.

S-A CONVEYING Systems

Move Coal "Over the Rooftops"

—at 40 Tons per Hour

Coal must move fast at this pulp and paper plant! And the S-A designed-and-installed conveying equipment makes it do just that—speeds coal from car to power house at the rate of 40 tons per hour. No matter what the bulk materials handling problem may be, S-A engineers have the experience and the equipment to solve it. To convey materials more efficiently and at lower cost, it will pay you to consult with S-A engineers—without, of course, any obligation whatever.

- Belt Conveyors
- REDLER Conveyor-Elevators
- ZIPPER Conveyor-Elevators
- Weigh Larries
- Crushers, Roll and Ring Type
- Bucket Elevators
- Pivoted Bucket Carriers
- Screw Conveyors
- Skip Hoists
- Belt, Pan & Plate Feeders
- Track Hoppers & Bin Gates
- TELLEVEL Bin Level Controls
- Water Intake Screens
- SEALMASTER Ball Bearing Units

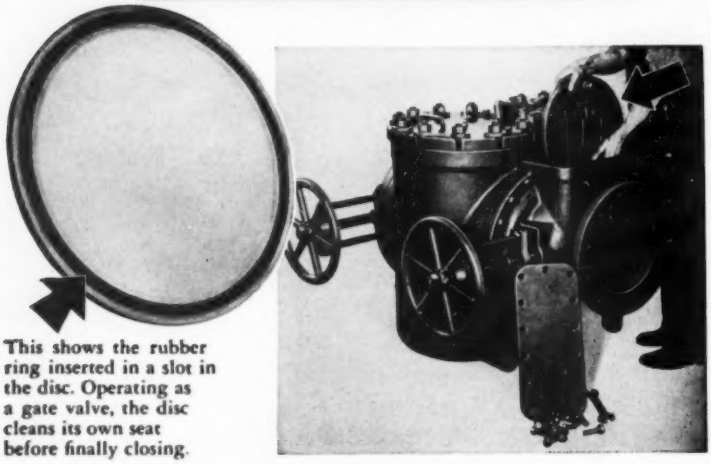
Write for a bulletin on any of the above

STEPHEN S-A ADAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Why TWIN STRAINERS have exceptional life*



This shows the rubber ring inserted in a slot in the disc. Operating as a gate valve, the disc cleans its own seat before finally closing.

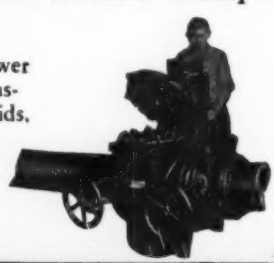
*THE REPLACEABLE DISC RING

This is a Neoprene ring embedded in the face of the disc. It insures tightness and if after long use wear occurs, it can be inexpensively renewed. For this purpose the disc can be removed through the top of the strainer in a few minutes without removing the strainer from the line.

*THE REPLACEABLE VALVE SEAT

Where liquids are exceptionally corrosive, a valve seat or "wear plate" can be supplied which can be replaced with a new wear plate when wear or pitting occurs. Not required under usual conditions, but just one more factor in adapting Twin Strainers to any service.

Many thousands of Twin Strainers in power plants, process plants, ships, and all industries needing non-stop clearing of liquids, have long demonstrated their sound qualities. Now redesigned for even better performance and lower operating cost. You will want the details — Bulletin A-13 on request.



A-316

ELLIOTT COMPANY
Accessories Dept., JEANNETTE, PA.
Plants in JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

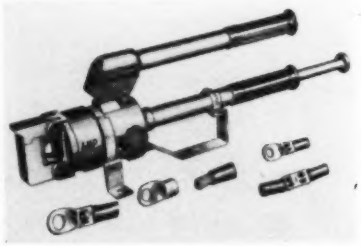
More EQUIPMENT NEWS

Begins on p 156

models, with speed ratios from 2 to 1 through 10 to 1.

Output shaft drives up, down or at right angles in the horizontal type, and down or at right angles in the vertical model. Handwheel control is standard, but electric remote and mechanical automatic controls can be applied. Bulletin M-522.

Reeves Pulley Co, Columbus, Ind.



Hand Hydraulic Tool

436 • Hand hydraulic tool crimps AMP heavy duty solderless terminals to stranded or solid wire. Tool has interchangeable die inserts for eight wire sizes from No. 8 to 4/0. The head has been redesigned and provided with a spring-loaded latch. This permits quick removal of completed terminal, as well as removing tool from continuous wire or changing the dies.

Head rotates 360 degrees to permit use in cramped or awkward locations. Tool develops 12 tons crimping pressure. Preliminary take-up holds terminal in dies while wire is inserted, pressure is released automatically when crimp is completed.

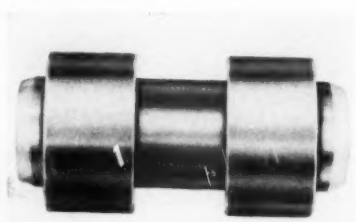
Aircraft-Marine Products, Inc, Harrisburg, Pa.

For more data on these items, use post cards p. 165. Identify your request with item number.

Temperature Control

434 • Small size temperature control operates between ± 300 F. It works on the principle of differential expansion of solids. Temperature sensing element consists of a high-expanding outer tube and a low-expanding inner member. Standard tube lengths are 5, 10 and 15 in., with the 10 in. length recommended for most applications.

Burling Instrument Co, 5 Vose Ave, S Orange, N. J.



Spacer-Type Gear Coupling

421 • New coupling makes it possible to remove hubs from either shaft without disturbing mountings of connected units. Unit

MIDWEST

The Only Change is in the Name

MIDWEST PIPING & SUPPLY CO., INC.

has Changed its Name to

Midwest Piping Company, Inc.

6283

Because the word "Supply" is no longer accurately descriptive of the major business operations of this company, the stockholders have voted to drop it from the corporate name.

There has been no change in management, ownership or business at Midwest . . . and none is contemplated. Only the name has been changed. Midwest continues all its activities in the fabrication and installation of piping, and in the manufacture of welding fittings.

MIDWEST PIPING COMPANY, INC.

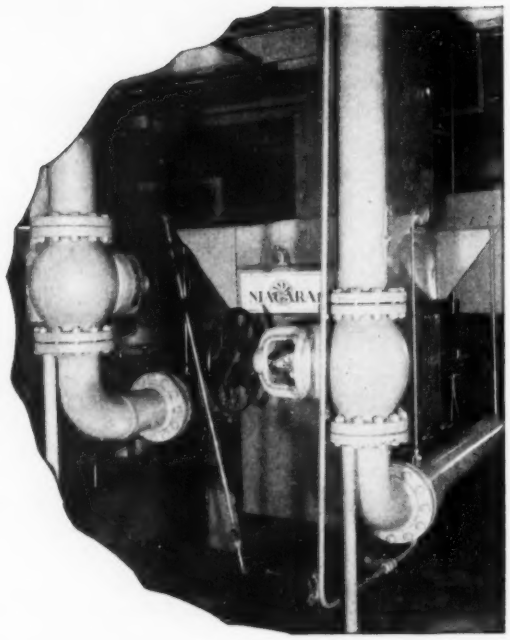
Executive Offices: 1450 South Second St., St. Louis 4, Mo.

Plants: ST. LOUIS, PASSAIC, LOS ANGELES and BOSTON

Sales Offices: NEW YORK 7—50 CHURCH ST. • TULSA 3—224 WRIGHT BLDG. CHICAGO 3—79 WEST MONROE ST. • LOS ANGELES 33—520 ANDERSON ST. HOUSTON 2—1213 CAPITOL AVE. • BOSTON 27—426 FIRST ST.

PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN 50 YEARS
MANUFACTURERS OF WELDING FITTINGS FOR MORE THAN 20 YEARS

How to get drier or cooler air or gases . . .



NIAGARA AERO AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate tools or pneumatic equipment you save much in water and oil damage to tools and equipment, and in water damage to materials by using the Niagara Aero After Cooler.

Write for a bulletin, or ask nearest Niagara Field Engineer if you have a problem involving the industrial use of air.

NIAGARA BLOWER COMPANY

Over 35 Years' Service in Industrial Air Engineering

Dept. P, 405 Lexington Ave. New York 17, N. Y.

Experienced Field Engineers in Principal Cities of U. S. and Canada

More EQUIPMENT NEWS

Begins on p 156

consists of flexible hubs on both driver and driven shafts. Spacer has specially designed teeth at either end, cut so they mate with each sleeve in a spline fit. Connections have no angular or off-set flexibility, but allow for end-float. Available in stock size from ⅞ to 3, capacity 4 to 80 hp per 100 rpm. Spacer lengths range from 4⅜ to 3⅞ in. Larger sizes and other spacer lengths available on request.

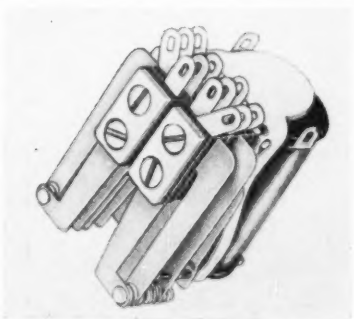
Sier-Bath Gear & Pump Co, Inc, 9252 Hudson Blvd, North Bergen, N. J.

Skylight Glass Block

409 • *Skytrol* glass block is especially designed for structural and optical use in skylights. Light-diffusing block is 12x12 in. square, 4 in. thick. Insulating value has been increased by adding a fibrous glass screen sealed in the block, creating a double cavity.

Pittsburgh Corning Corp, 307 Fourth Ave, Pittsburgh 22, Pa.

For more data on these items, use post cards p. 165. Identify your request with item number



Telephone Type Relays

457 • MJ series miniature telephone type relays feature longer, more flexible contact arms resulting in a lower spring load rate. This combination permits wider contact gap, more overtravel, improvement in sensitivity, faster action and longer life, manufacturer claims. Available with a maximum of 4 Form C contacts for either dc or 60

PHILADELPHIA
Worm Gear Reducers

...GIVE YOU ALL THESE FEATURES

Worms are of alloy steel with carburized, hardened and tempered threads (both shaft and threads are accurately ground *after* heat-treatment.)

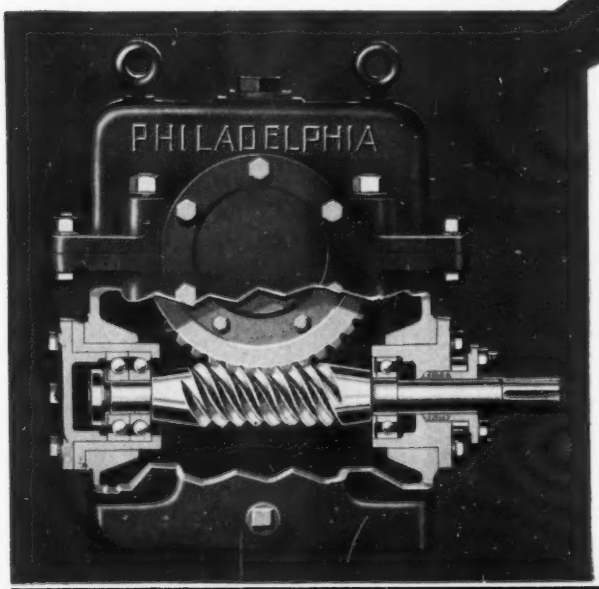
Worm Gears are of highest quality chill-cast nickel bronze.

Bearings are anti-friction types (ball or roller) best suited for smooth, quiet, long-lived operation.

Housings are Quality Grey Iron, compact, rigid, neat and of ample radiating surface (to prevent overheating).

Lubrication is by Splash Systems to all moving parts—in oil-tight housing.

A.G.M.A. Ratings are carried by all Philadelphia Units.



Units are available with *Worms above or below* the *Worm Gear* for Horizontal Drives, or with shafts extending *up* or *down* for Vertical Drive requirements . . . all in single or double reductions. And, for very efficient Right Angle Drives, there is a complete line of Philadelphia *Helical-Worm Gear Reducers.*

For Vertical Drives requiring long unsupported shafts, there is a complete line of Type VTS Units, known as *Philadelphia Vertical Steeple-Type Worm Reducers.*

Send for 88 page *Worm Reducer Catalog,* which gives full data for ordering; diagrams; installation views; section views of all units, etc.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

"JOHN CRANE" SUPER SEAL PLASTIC PACKING No. 1

Boiler plant operators of high speed centrifugal boiler feed pumps have long been looking for a satisfactory packing for these important units. Speeds have advanced from 1750 rpm. in 1910 to 5000 rpm. today, with shafts ranging up to 3½" diameter. Handling hot condensates up to 430°F. and pressures to 1250 psi. are no longer uncommon. High speed centrifugal boiler feed pumps go into service with lightning speed. The friction heats ordinary packing in a very short time. The oil and lubricants in these packings are boiled out and the asbestos seizes around the pump sleeves. Extensive damage and costly shutdowns result.

"JOHN CRANE" Super Seal Plastic Packing No. 1 is different!

This packing has a dry flake graphite lubricant. Every asbestos fiber is impregnated with graphite. The body of the packing is a combination of non-frictional metal particles. Asbestos fiber, graphite and rubber binder are semi-vulcanized as a mass, forming a resilient, flexible, non-frictional, strong packing.

"JOHN CRANE" Super Seal Plastic Packing No. 1 compresses satisfactorily under gland pressure to provide a perfect fit in the stuffing box. With proper lubrication, the packing runs cool and seals with minimum leakage. There is no lubrication to run out. The graphite surfaces polish the sleeve.

Operating engineers prefer "JOHN CRANE" Super Seal No. 1 for high speed centrifugal boiler pump service. Supplied in spirals, coils and die-formed rings and sets to fit all stuffing boxes.

Write today. Ask for our illustrated catalog. Crane Packing Co., 1830 Cuyler Ave., Chicago 13, Ill.

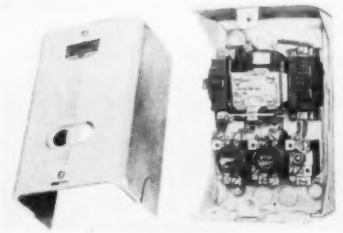
JOHN CRANE **CRANE PACKING COMPANY**

More EQUIPMENT NEWS

Begins on p 156

cycle ac operation. Coils furnished up to a maximum resistance of 22,000 ohms. Insulation resistance better than one thousand megohms and breakdown tested at 500-v RMS. Open relay measures 1 in. wide, 1-17/32 in. long, 1-3/15 in. high.

Potter & Brumfield, Princeton, Ind.



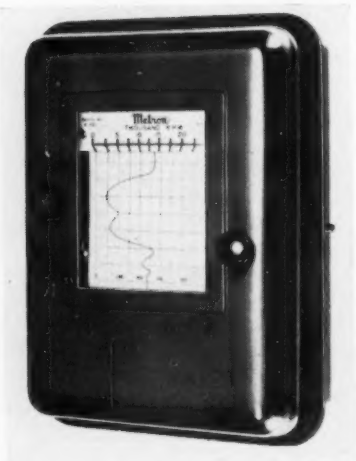
Magnetic Starters

444 • New line of magnetic starters, contactors and relays incorporates a simple 5-unit construction. The 5 independent parts consist of 2 contact blocks, a magnet coil, an armature and a 3-coil or 2-coil overload relay mounted on a steel panel. Each part can be removed from the front without disturbing another part.

The new line features a 3-coil, adjustable overload relay permitting 4 ratings from each heater coil by changing its position. Manufacturer claims this provides protection within 3% of full load motor rating. All terminals face front, have solderless connectors that grip solid or stranded wire.

Cutler-Hammer Inc, 315 N 12th St, Milwaukee 1, Wis.

For more data on these items, use post cards p. 165. Identify your request with item number.

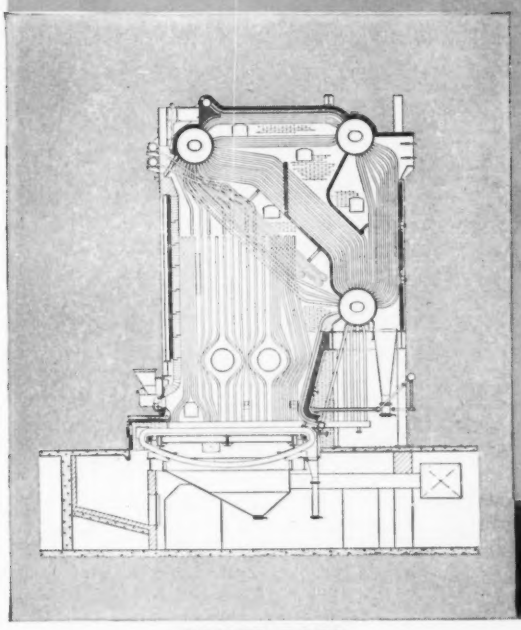


Speed Recorders

422 • Series 81M strip chart recorders are General Electric type CF-5 instruments modified for use with Metron tachometer indicators and heads to record speed. Eighteen different speed ranges are available from 0 to 50 to 0 to 100,000 rpm, fpm, cycles per minute, yards per hour, inches per minute, or virtually any speed units.

10,000 People are proud of their UTILITY

CITY OF FAIRMONT, MINNESOTA



BOILER DATA

2—E.C. 3-drum—80,000 lbs./hr.—750°F (TT)—399 lbs. O.P.—425 lbs. D.P.—water cooled side and rear walls—Erie City "Travagrate" Spreader Stoker with 12,000 B.t.u. Illinois coal and gas firing.

An Outstanding Record of Performance

1930—All Rates Reduced
1931—Power Rates Reduced
1932—Commercial Rates Reduced (Lights)
1933—Water Rates Reduced
1934—All Rates Reduced
1936—Power and Resident Light Rates Reduced
1940—Commercial Light and Power Rates Reduced
1943—All Electric and Steam Heat Rates Reduced
1945—All Electric Rates Reduced
1949—Increased costs forced 10% increase in all rates

The City of Fairmont, Minnesota, population 10,000, operates its own light, power, water and low pressure commercial steam heating services. The power plant, rebuilt in 1920, houses one 40,000 and one 60,000 pound boiler and two 80,000 pound per hour Erie City 3-drum steam generators added in the past five years. Its kwh generated has increased from 1.8 to 34.6 million in 1951.

The late G. E. Basom, had devoted 28 years to the careful management of this utility. Its outstanding record of rate reduction over the years is a monument to his devotion to the public trust. It is also a matter of great pride to this community that not one cent of taxes was required for financing their utility.

We are proud to have Erie City "Travagrate" Spreader fired Erie City 3-drum steam generators serving the City of Fairmont.

You can depend on Erie City for sound engineering

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

WHY INSULATE YOUR CONDENSER TUBES?

You may be doing just that if your plans don't include CHLORINATION EQUIPMENT for slime control by WALLACE & TIERNAN.

Chlorination equipment because it controls slime that *grows* on the walls of condenser tubes not protected against it. Enough of the growth eventually seriously reduces heat transfer efficiency — actually *insulates* your steam from the cooling water. Back pressures go up, production drops, operating and maintenance costs rise, and eventual shut-down becomes necessary for regular clean-out periods.

Wallace & Tiernan equipment because it is versatile, sturdy and dependable — proven by thousands of successful installations, vouched for by satisfied users everywhere-and because there's a Wallace & Tiernan chlorinator for every job. Write today for information on how Wallace & Tiernan chlorination may help you solve *your* slime problem.

NO WATER IS SLIME-FREE

regardless of the source. Chlorination helps reduce slime in make-up or cooling water.

CD-37

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

More EQUIPMENT NEWS

Begins on p 156

Recorder may be as much as 1000 ft from the engaged speed. Duty is continuous up to 30 days on a single roll.

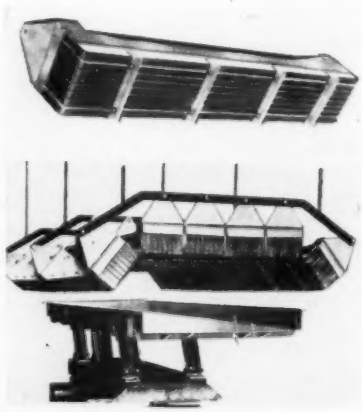
Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

Slack-Tube Manometer

458 • Series No. 1211 flexible slack-tube manometer is equipped with a convexed spring-steel scale for rigidity in use and flexibility for convenient carrying. It rolls up into a small unit to fit pocket or service kit. Body is made of vinyl-plastic. It can be rolled, twisted or bent into any shape, will return to a full-length, easily read and accurate U tube. Available in standard ranges from 8 in. to 10 ft in water or mercury.

F W Dwyer Mfg Co, 317 S Western Ave, Chicago 12, Ill.

For more data on these items, use post cards p. 165. Identify your request with item number



Radiant Heating Panels

418 • Infra-red radiant heating panels heat by direct radiation, eliminating the use of reflectors. Panels throw a flat, uniform radiating pattern that lowers production costs and time on baking, drying and

Fig. 6003 W. E. 600-pound Cast Steel O. S. & Y. Gate Valve with welding ends.

The name "POWELL" on a valve assures absolute dependability

Naturally, in buying a valve, the first consideration is its ability to perform a specific service. But that is not all. For it must also be a valve that will continue to function dependably for a long time. Powell Valves have an established reputation for this dependability.

The Wm. Powell Company
Cincinnati 22, Ohio

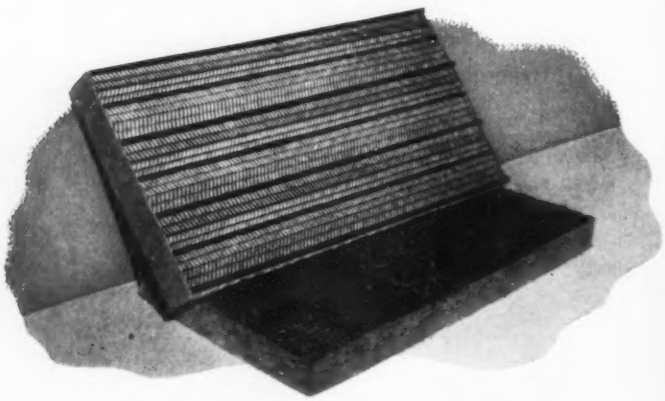
POWELL

DEPENDABLE VALVES SINCE 1846

BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES

Copr-fibre

LAMINATED
Long-fibre BLANKETS

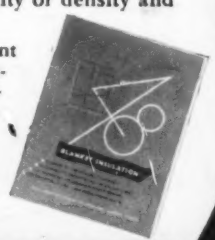


Vastly Improve Insulation
APPLICATION . . . EFFICIENCY . . .
PERFORMANCE!

Here's Why: Copr-fibre Blankets are made by laminating long, mineral wool fibres together to form a tough, resilient blanket *before wire mesh is attached.*

As a result this exclusive Copr-fibre two-stage manufacture gives you these advantages:

- **FASTER APPLICATION,** because laminated blankets cannot loosen or fall apart under the abuse of handling. And because Copr-fibre blankets come in convenient large sizes, are light in weight, clean, shot-free.
- **MORE INSULATING EFFICIENCY,** because laminated, longer fibres guarantee lower thermal conductivity. Two-stage manufacture is your insurance of uniformity of density and of consistency in all dimensions.
- **BETTER PERFORMANCE,** because resilient long-fibre Copr-fibre blankets maintain integrity, both of insulation and weatherproofing, throughout expansion and contraction cycles of heated and cooled equipment.



SEND FOR THIS BULLETIN. Copr-fibre Bulletin 511 gives you all the facts on what we believe is the only *modern* blanket insulation. Your copy will be sent free upon request. Write today.

FORTY-EIGHT INSULATIONS, Inc.
Telephone: Aurora 9207
AURORA, ILLINOIS

More EQUIPMENT NEWS

Begins on p 156

heating processes. They are made with from 2 to 8 of the flat surface elements backed up by thermal insulation, securely mounted to a steel box type frame equipped with mounting flanges. Panels can be set up to form ovens, dryers, heaters, etc, for operation on any commercial ac or dc frequency.

Syntron Co, Homer City, Pa.

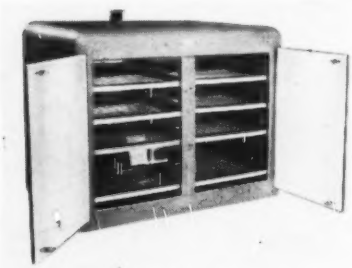
Submersible Cellar Drainer

407 • Fig. 4667 cellar drainer will drain boiler rooms, tunnels, elevator pits, etc. Entire unit can be submerged without damaging the motor. Switch is completely automatic and sealed inside motor case. Pump is bronze with a hard rubber semi-open impeller. Motor is 1/3 hp, 116 v, 60 cycle, 1750 rpm, split phase.

Pipe connections are 1¼ in. The unit is 16 in. high and will fit into an 11 in. diameter sump. Capacity ranges from 1200 gph against a 22 ft head to 3000 gph against a 5-ft head. Bulletin 4660.

Deming Co, Salem, Ohio.

For more data on these items, use post cards p. 165. Identify your request with item number.



Portable Oven

425 • Model PL 2A 8-compartment portable oven is recommended by manufacturer for moisture stabilization and storage of low hydrogen, stainless steel, hardenable steel and other welding electrodes. Oven features low operating cost, adjustable temperature control to 325 F; portability; operation from 110 v ac outlet; fan driven

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Engineered FOR SMOOTH FLOW

TUBE-TURN Eccentric Reducers are designed with strong knuckle contours and as gentle transitions from large to small diameters as possible. In addition to providing smooth inner walls at the joints, these features hold turbulence and pressure loss to a minimum.

Efficient piping flow reduces pumping power requirements, and investment in equipment. For efficient, leakproof piping, specify welded systems—using TUBE-TURN Welding Fittings and Flanges.

You'll find a TUBE TURNS' Distributor in every principal city. Call him for good service in good connections.

Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO

PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA. • KEROTEST MANUFACTURING COMPANY, PITTSBURGH, PA.

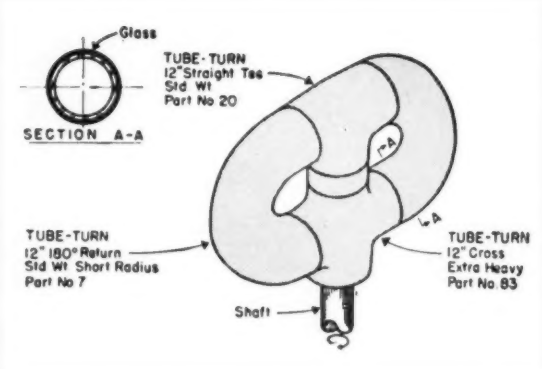
ENGINEERING SERVICE

TUBE TURNS' *Engineering Service*

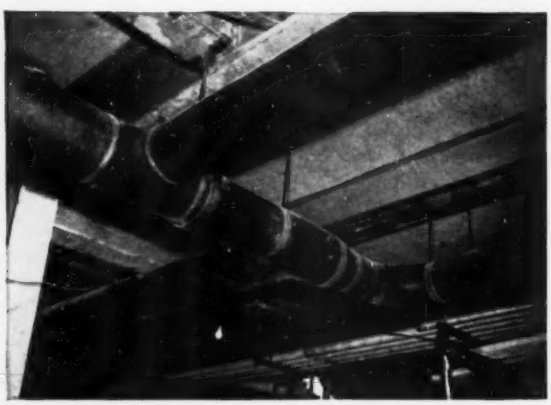
HELPS SOLVE A VIBRATION PROBLEM

TUBULAR CONSTRUCTION often solves tough machine design problems and here, as in piping problems, Tube Turns' Engineering Service is ready to help you! For example:

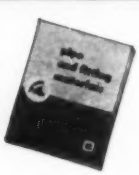
Vibration was cracking the glass coating of a plate type agitator for a brine tank in a chemical plant. After repeated replacements, the engineers decided to switch to tubular construction and called in Tube Turns' Engineering Service for design assistance. The resultant design, shown in the sketch, embodies great rigidity and is not affected by the vibration. The expensive maintenance caused by cracking of the agitator's glass coating was eliminated.



FABRICATION IS FAST. Field or shop fabrication of piping assemblies is easier when welders can count on the dimensional accuracy of TUBE-TURN Welding Fittings. True circularity and uniform wall thickness assure perfect lineup and fit.



AT GENERAL ELECTRIC. Two 16-inch steam mains, at boiler plant of the new G-E Appliance Park in Louisville, will help distribute 900,000 pounds of steam per hour efficiently. Welded piping, using TUBE-TURN Welding Fittings and Flanges, was specified for all critical lines in the new plant: high and low pressure steam, gas, domestic and mill water, and compressed air.



TUBE TURNS, INC., Dept. C-4
224 East Broadway • Louisville 1, Kentucky

Your name .....

Position .....

Company .....

Nature of business .....

Address .....

City ..... *State* .....

DISTRICT OFFICES

New York	Houston
Philadelphia	Tulsa
Pittsburgh	San Francisco
Chicago	Los Angeles

"TT" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

HALL INDUSTRIAL WATER REPORT

Hall Laboratories, Inc.—A Subsidiary of Hagan Corporation, Pittsburgh, Pa.

Volume 1 | APRIL 1953 | Number 2

Water as a Raw Material

The sea is a vast storage bin of elements necessary for 20th century industry. Extraction of elements requires the handling of tremendous quantities of water; 300,000 gallons of water to get a ton of magnesium, 5 million gallons for a ton of bromine.

Water is necessary to all industry, where it is used as a solvent, a carrier, a diluting element, dispersing and cooling agent, for cleansing. Water is your industry's most important raw material—don't waste it!

From British West Indies To Japan, Hall System* Goes International

Alex Henricks, engineer on the Hall headquarters staff, by-passed three weeks of U.S. winter weather in the British West Indies, where he initiated Hall System* in a sugar factory boiler house. This plant had asked advice of a local company (a Hall client) after suffering tube losses due to corrosion.

And Hall "know-how" in industrial water conditioning is now being exported to the Orient. Japan Organo, Ltd., representing Hall Laboratories, is introducing Hall System* and applying Threshold Treatment with Calgon* to cooling water as well as to various process industries. To accomplish this, Mr. Tadashi Nagao, chemist for 20 years with a Manchurian utility, recently spent 6 weeks at Hall headquarters.

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information, write, wire, or call Hall Laboratories, Inc., P. O. Box 1346, Pittsburgh 30, Pennsylvania.

SLUDGE-STALLED BOILERS BACK ON THE LINE

Sometimes it's just plain sludge, but the unusual keeps Hall engineers hunting for process leaks

In one specific case, use of only 30 per cent of unsoftened make-up caused sticky sludge accumulation in tubes, and so deep in the drum that the feed pipe was almost covered. A quick analysis of this sludge by Hall Laboratories identified it as calcium phosphate, magnesium silicate, and magnesium phosphate.

Burosil* fed to the boiler precipitated the magnesium as magnesium silicate. Now boilers are virtually sludge-free, and operate through the entire heating season, instead of having to be cleaned at 2-month intervals, as formerly.

That was a normal problem. But the boiler water of a ceramic plant contained a lot more suspended matter than should have been there. A check on the feedwater by the Hall engineer showed why—it was carrying clay "slip."

When a break in the condensate line was located and repaired, no more "slip" was pulled into the system by the vacuum return system, and boiler operation returned to normal.

Once in a while, the Hall men run onto a corker. Like the boiler sludge that developed in a plant which makes certain catalysts. A sudden drop in boiler water alkalinity heralded the trouble. Make-up water composition had not changed, but inspection revealed an exceptionally heavy sludge. Analysis of the boiler water showed 5 times the normal dissolved silica concentration. Suspended solids showed high silica and alumina. Guided by these clues, the operators and Hall men traced the trouble to one of the process heat exchangers. Several leaky tubes were found which contaminated the condensate returns with catalyst.

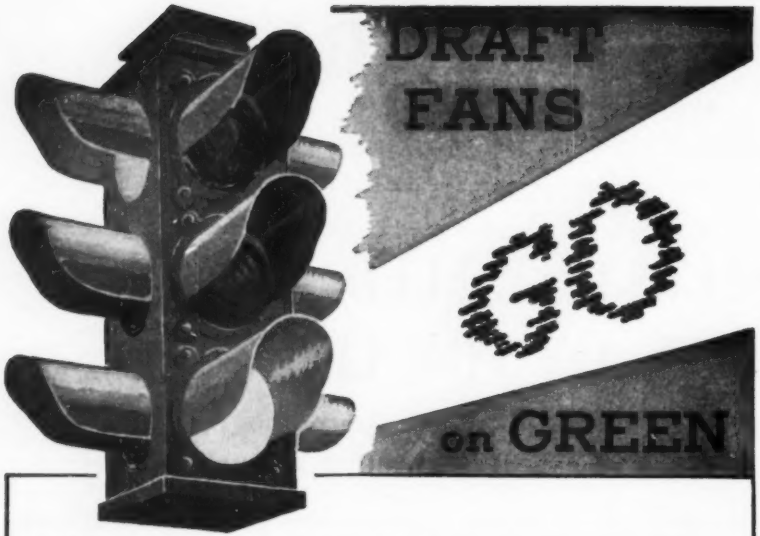
It sounds easier, in capsule form, than it really was; however, the sludge problems were handled quickly, because in each case, facts developed at Hall Laboratories pointed a way to the solution.

Equipment for Water Analysis Shown to Pittsburgh Conference

In early March, Hagan Corporation exhibited apparatus, developed by Hall Laboratories for use in water analysis, to the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy. Electrical conductivity equipment, cooling coils, and the Hagan Automatic Degasser for securing gas-free samples of condensed steam were shown.

Hall Certified Reagents were featured together with associated equipment for running Schwarzenbach hardness titrations, a new rapid anion exchange method for solids in boiler water, and other selected colorimetric and titration procedures.

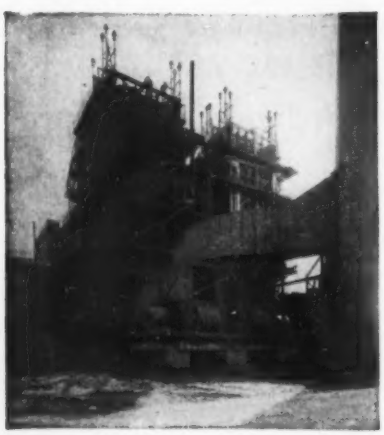
*"Calgon" and "Burosil" are registered trademarks. "Hall System" is registered as a service mark by Hall Laboratories.



GREEN FANS . . . Used by Many Leading Utilities

One significant fact about Green Fan Installations at the New Orleans Public Service Plant is that two different boiler manufacturers were involved . . . two different types of boilers but Green Draft Fans for all three boilers. Each boiler has two Green Induced Draft Fans and one Green Forced Draft Fan.

When a concern has specialized on an important piece of power plant equipment for many years, that firm is rightly called the "authority" on the subject. This is the position of Green Fuel Economizer Co. in the field of mechanical draft fans. The name Green is synonymous with Draft Fans highly acceptable to industry.



The Line of Green Induced and Forced Draft Fans includes many types in many sizes which are described in Bulletin No. 168. We shall be glad to discuss your fan requirements with your own engineers, with your consulting engineers and with the boiler manufacturer of your choice.

THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

More EQUIPMENT NEWS

Begins on p 156

forced circulation of air which forces moisture out; adjustable damper for control of temperature. Oven is 30 in. wide x 25 deep x 24 high, shelves are of expanded metal. Specifications can be varied to suit application.

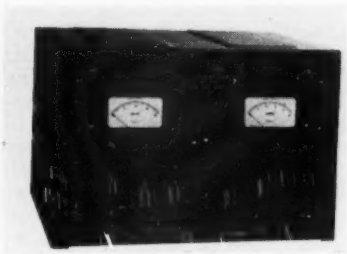
Grieve-Hendry, Inc, 1815 W Lake St, Chicago 12, Ill.

Packless Valve

449 • Model *Demi-G* is a packless, tamper-proof globe valve for hydraulic, pneumatic or vacuum service with pressures up to 1500 psi in brass and aluminum. It can be used for oil, water, gas and corrosive systems. Body is manufactured from bar stock. Standard size has maximum ¼ in. ips or ¼ in. integral tubing connections.

George W Dahl Co, Inc, Bristol, R. I.

For more data on these items, use post cards, p. 165. Identify your request with item number



Power Supply

451 • Magnetic amplifier regulated power supply, model MR532-15 is rated 5 to 32 v, dc, 15 amp, has no tubes. Manufacturer claims regulation accuracy of ± 1% for dc load variation from no load to full load. Unit is also stabilized for ac line variation from 105 to 125 v, ac.

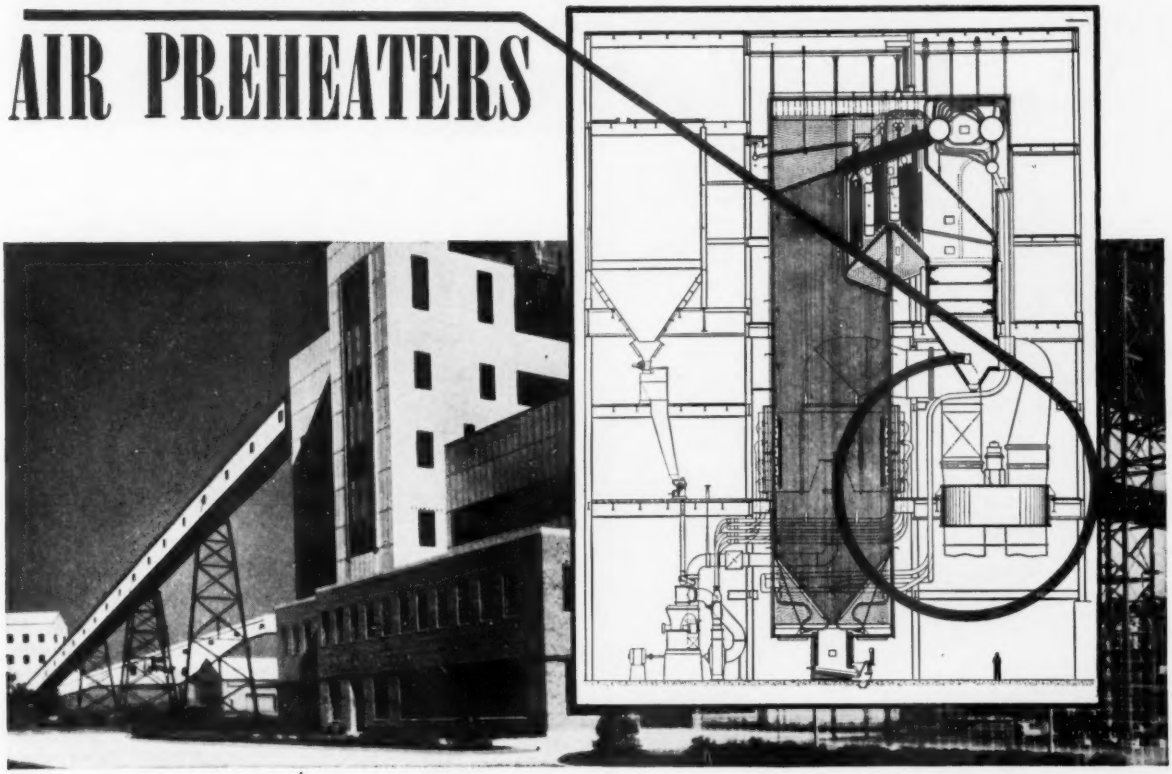
Perkin Engineering Corp, 345 Kansas St, El Segundo, Calif.

(*Continued on page* 188)

All Boilers at New Plant Yates of the Georgia Power Company

equipped with

LJUNGSTROM AIR PREHEATERS



Geared to provide increasing facilities to keep pace with Georgia's growing power demands, Georgia Power Company's new Plant Yates Station is now producing 200,000 kilowatts with a third 100,000 kilowatt unit scheduled to go in service this fall. The station was designed and engineered by Southern Services, Inc., of Birmingham.

Each 100,000-kw turbine-generator in this new plant is powered by a Combustion Engineering—Superheater Steam Generator, designed for pulverized coal firing, and natural gas as an alternate fuel. Each C-E Boiler generates 975,000 pounds of steam per hour at 1325 psi and 950 F.

All of these modern steam generating units have been designed to incorporate two Ljungstrom Air Preheaters. These Ljungstroms are designed to preheat incoming combustion air to 655 F, and cool stack gases to 300 F.

Plant Yates is another example of the widespread acceptance of the Ljungstrom Air Preheater — by boiler manufacturers, consulting engineers, and utilities. Since the war, over 285,000,000 pounds of steam capacity per hour have been designed to incorporate the Ljungstrom . . . another proof that Ljungstrom Air Preheaters are standard equipment for high efficiency steam generating units.

THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

You'll Avoid "Jam Sessions"

with

DARTS

...the Union that gives a Drop-Tight Closure!

This True Ball Joint Makes the Difference

DART UNIONS don't get tight, stay tight because of an ordinary "jammed" joint. Their tightness comes from a precision-ground, bronze-to-bronze ball joint that comes apart readily and remakes repeatedly — as tight as when new.

Both seats are non-corrosive bronze for top protection against pitting and corrosion. Nuts and both ends are high test, air refined malleable iron — practically indestructible in use or abuse.

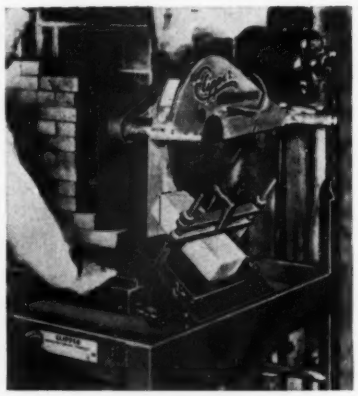
Remember, the *extra* work life of a Dart is money in your pocket! Darts can be installed and reinstalled, time after time, with absolute assurance of tightness.

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston New York Pittsburgh

DART
UNIONS

More EQUIPMENT NEWS

Begins on p 156



Masonry Saw

459 • *Dustless* Clipper masonry saw cuts special shapes from standard refractory stocks.

Model HD features a pressure equalizer spring that automatically cushions the blade, giving longer blade life. Operator can easily adjust the cutting head to any desired height. Other features are: a factory sealed water pump that operates wet or dry; a patented *hinge-lok* blade guard that serves as a safety device and eliminates water spray when wet cutting.

Clipper Manufacturing Co, Suite 678, 2800 Warwick, Kansas City 8, Mo.

For more data on these items, use post cards p. 165. Identify your request with item number

One-Man Fire Engine

408 • Dry chemical, wheeled fire engine has a capacity of 150 lb. Model 150 weighs only 480 lb. fully charged, and can be easily wheeled, maneuvered, and operated by one man. It carries the inspection and approval label of Underwriters' Laboratories, with B and C classification. The expellent is dry nitrogen, with a sustained operating pressure of 200 psi during the entire period of discharge.

American-La-France-Foamite Corp, Elmira, N. Y.

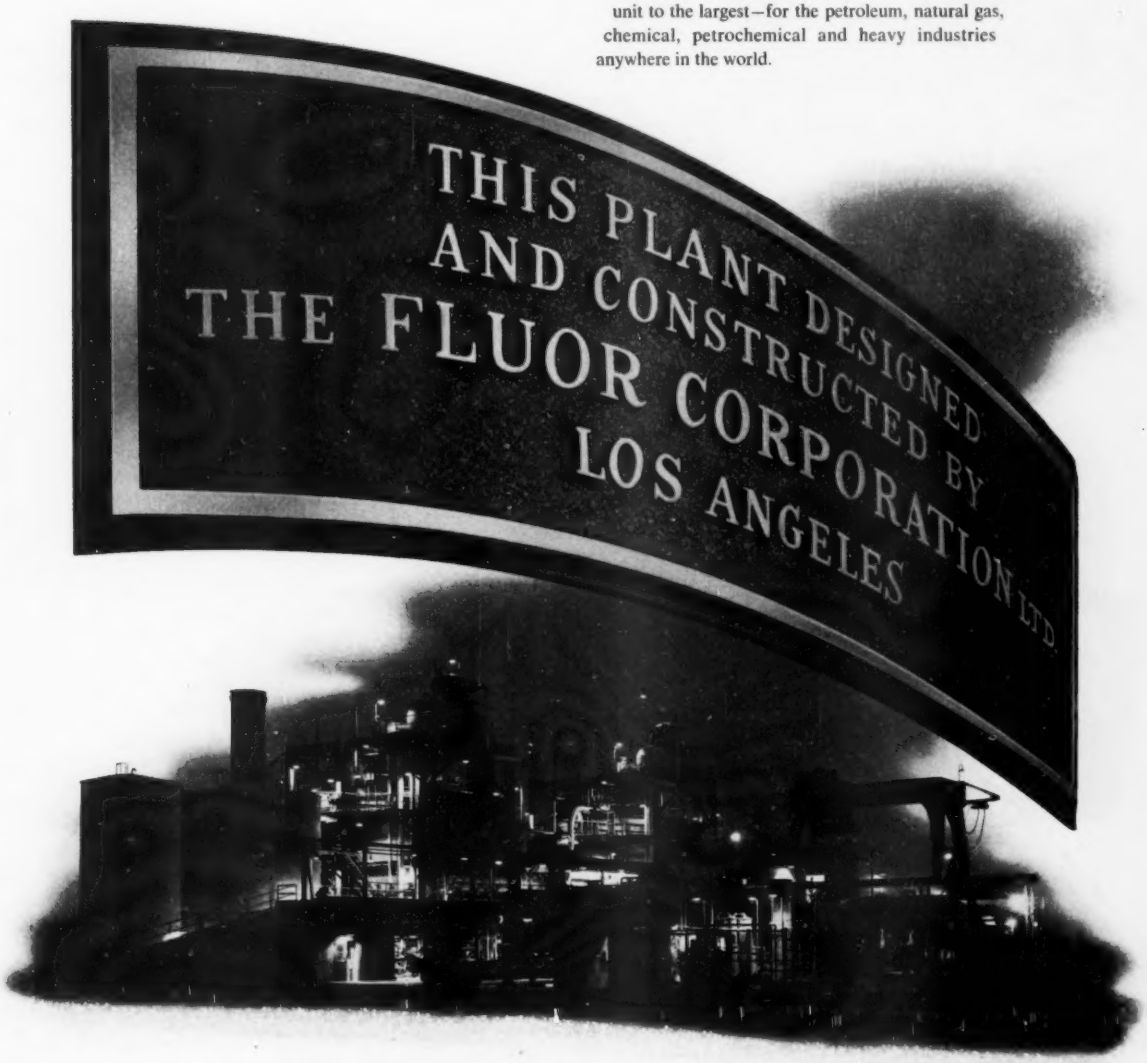
Tubing Test Stand

460 • Automatic, air and hydraulically actuated test stand can be used for determining the physical characteristics of any seamed tubing up to 3" in dia. Test specimens of steel, stainless steel and carbon steel tubing can be checked for flaring, column and crushing strength with pressures up to 100,000 psi.

Unit is designed to assist quality control in production of electric-welded tubing used for boilers, heat exchangers for exhaust gas coolers, etc. Stand is self-contained, requires only a connection to 60-80 psi air supply. Operation is by solenoid, push-button control after the test specimen is inserted between fitting anvils.

The Dommers Co, 428 S Cherry St, Wallingford, Conn.

HIGHGROVE, CALIFORNIA. California Electric Power Company's new, modern 60,000 KW steam-electric generating plant now in commercial operation here was designed, engineered and constructed by The Fluor Corporation, Ltd. Many design innovations make this plant one of the most unique in existence. Except for the control rooms and switch gear the plant is completely outdoors and was planned for operation with an absolute minimum of attending personnel. The entire job was completed in advance of the originally scheduled operating date notwithstanding the extreme difficulty of obtaining some items of material and equipment. Additional units are being added to bring the total output to 140,000 KW. Fluor's ability to build efficient power plants has been ably demonstrated many times and is recorded in the illustrated brochure, "The Highgrove Story." Copies are available upon request. Fluor's broad experience also extends into the design and construction of all types of facilities—from the smallest unit to the largest—for the petroleum, natural gas, chemical, petrochemical and heavy industries anywhere in the world.



BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD.
LOS ANGELES 22 CALIFORNIA

FOREIGN: FACTS-FLUOR PARIS
FLUOR OF CANADA TORONTO
FLUOR INTERNATIONAL-BEIRUT
HEAD WRIGHTSON LONDON

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA

an ACCO product

R-P&C No. 531-P Bronze Globe Valve Full Plug

1. Cross-bar, malleable iron handle and identification plate
2. High tensile, high torque rolled bronze stem
3. Heavy, deep packing nut
4. Even-pressure gland
5. Large, deep stuffing box can be repacked under pressure
6. High-test bronze bonnet with smoothly machined bevel for perfect seal with bevel of body
7. Heavy, rugged bronze union ring won't distort body or weaken threads
8. Stainless steel, heat-treated disc and seat ring. Full plug type. Machined as matched pairs for perfect fit and positive shut-off. Easy to replace
9. Heavy section, high-test bronze body with rugged reinforcing ribs
1
P&C Co.
350

WHY Your Money Buys More in R-P&C Bronze Valves

● Every part of every bronze valve is made right in the R-P&C plant. From the designing of the pattern, the pouring of the molten bronze, the machining, polishing, fitting, inspecting, and testing . . . every operation is under the watchful eye of R-P&C Valve craftsmen.

They like to make valves, good valves, and they build into the complete line of R-P&C valves the quality that gives you more for your money. Specify R-P&C Valves on your next order.

Write our Reading, Pennsylvania office for literature on the types of valves you use

ACCO

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

MARMADUKE

Continued from page 144

sent over their 'experts,' but no one suggested a way to save tearing down that press.

"Just as the maintenance gang had chainfalls strung up and tools scattered around to rip that press down, who should visit the plant but Jack Hartley. Jack had been in the packing business for more years than anyone I knew. I understand he's up in Boston now and still does a lot of trouble shooting.

"With the sick press worrying the plant engineer, Jack was about as welcome as low water in a boiler. No packing salesman had come up with anything like a solution, so the plant engineer cut Jack short. But finally he let him look the press over.

"After examining the ram, Jack asked for a chance to try an idea he had. Said it would take only a few hours. If it didn't work, they could go ahead and tear down the press.

"There was nothing to lose and plenty to gain, so the Boss told Jack to go ahead.

" 'Just give me two mechanics,' said Hartley. Two men were assigned while everyone wondered what in hell he would do with them. Jack put them to work tearing out the old chewed-up leather packing. Then he got in his car and drove to a mill-supply house. Soon he came back with balls of plumber's twine, the kind that's coated with lead.

"He had the mechanics calk the twine into the packing box, while he sprinkled graphite over the 'packing' from time to time. The gland was finally pulled tight, then removed, and more leaded twine and graphite calked in.

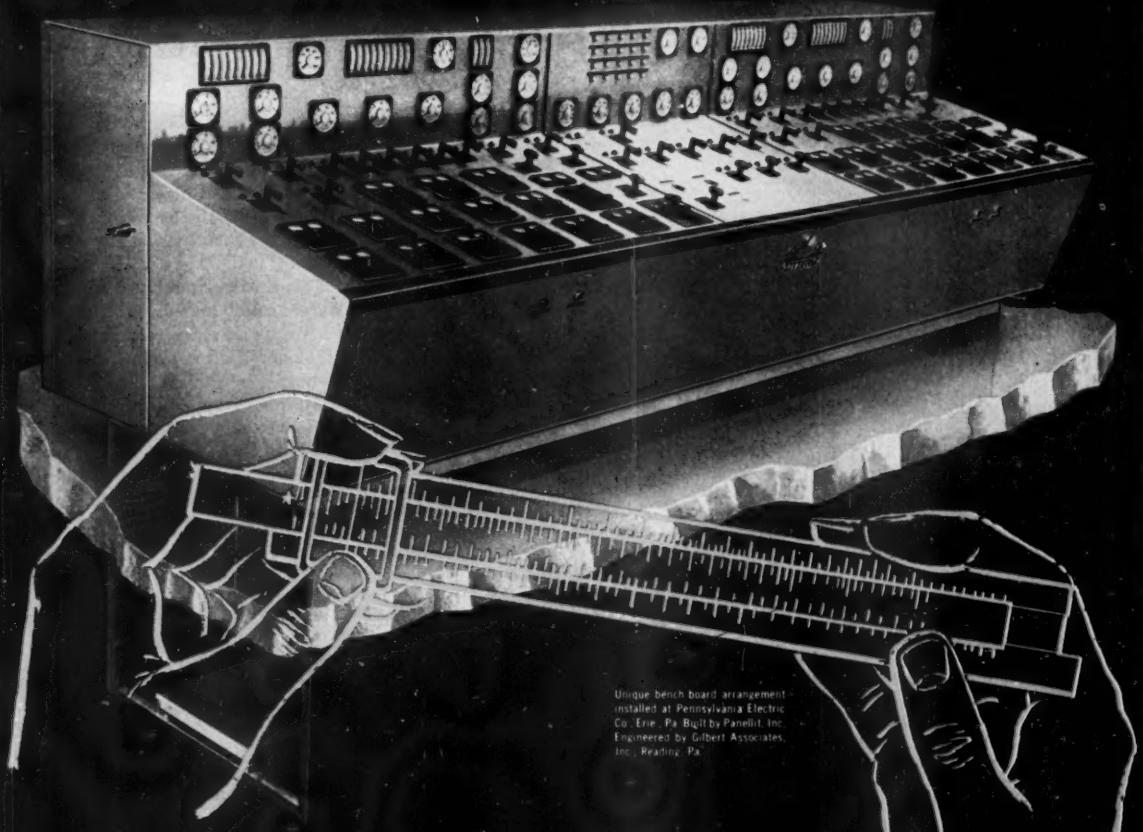
"After a few hours the gland was tight and the press ready to start. The ram groaned and moaned, and ripped some of the packing. But the burrs had rounded off a little after that first stroke. Evidently that lead reinforced with twine was a lot tougher than leather.

"The gland was tightened again, and the ram run up and down a second time. This time there was less leakage. Again the gland was tightened down. After a half dozen times of running the press and tightening the gland, the burrs were gone. And the rough grooves had filled with lead and graphite.

"Jack hung around until noon, while that press worked tires with that calked plumber's twine. By then that ram worked as good as new and there was no further leakage.

"It just goes to show," philosophized Marmy, "that you can kill a hog without breaking his legs and letting him bleed to death.

"But here's the stinger," roared Marmaduke. "Jack Hartley was all set to



Unique bench board arrangement installed at Pennsylvania Electric Co., Erie, Pa. Built by Panellit, Inc. Engineered by Gilbert Associates, Inc., Reading, Pa.

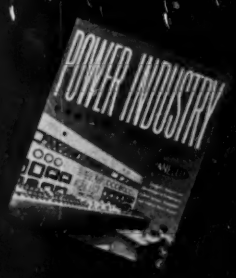
putting imagination to the rule . . .

Practical, new ideas in control systems are making the operation of power generating stations and sub-stations easier . . . better . . . more economical . . . and more dependable today.

Many recent, outstanding installations in the power field have been built by PANELLIT . . . and reflect the *imaginative engineering* of the PANELLIT organization.

PANELLIT builds only control systems and panelboards. It does not manufacture instruments or controls, thus its engineering assistance and equipment recommendations are always independent of sales considerations.

PANELLIT maintains a separate Power Division in its Engineering Department, as well as divisions for other specialized fields of application. It is this complete understanding of our business and your application that has enabled PANELLIT to establish new standards in power and process industry instrumentation.



NEW LITERATURE entitled "POWER INDUSTRY CONTROL SYSTEMS" will gladly be sent to you upon request. Ask for Bulletin 3010.

PANELLIT

. . . engineers and builders of control systems, panelboards and Panelgraphs

Copyright 1953—Panellit, Inc.

PANELLIT, INC. 6312 NORTH BROADWAY CHICAGO 40, ILLINOIS

Get this *SMALL* TRAP

With

BIG TRAP quality features!

TEST
STRONG
OUTLET
INLET
DRAIN
• Renewable seat—easily removed for servicing.
• Strong's patented, wear-resistant Anum-Melt† valve and seat—guaranteed leak-proof for one year. Scientifically designed Hi-Cap° orifice gives greater capacity.
• Oversized ports—increased capacity.
• Horizontal inline connections—simplifies piping.
• Stainless 18-8 high ratio leverage.
• Large gasket area.
• Seamless, deep drawn, stainless 18-8 bucket—no welds.
• Bottom drain or inlet connection.

Available for pressures from 0 to 150 p.s.i., the Strong* No. 070 fits all standard trap applications. Built especially for use on laundry, restaurant and hospital equipment and in industry wherever small drainage is a problem.

As with all Strong Semi-Steel Traps, the 070 is guaranteed against defects in material and workmanship for one year. Write today for Catalog 68-I.

*T. M. Reg. U. S. Pat. Off.

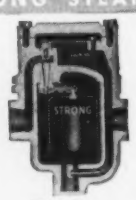
STRONG, CARLISLE & HAMMOND COMPANY

1392 WEST 3rd Street
Cleveland 13, Ohio

† ANUM-MELT Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

Reducing Valve



Blast Trap

"SY" Strainer

STRONG

MARMADUKE

Continued from page 190

get their leather-packing business and had his order book ready."

"I'll bet he got a nice order," I was foolish enough to say.

"Order, hell!" bellowed Marmaduke, "One of the maintenance men suggested cutting up old leather-shop belts for packing instead of spending money for regular hydraulic leather like Jack sold. And that's exactly what the boss agreed to do.

"So Hartley was down in the dumps when he left the plant. And as far as I know he never did get a nickel's worth of business after saving them all that money."

Marmy dropped his size 16 canal boats to the deck and turned back to his blueprint. I took the hint and left his office, without saying another word. But halfway back to my office I realized that he hadn't told me what in hell a KNIBBLING PIN is. Now I'm wondering if anyone knows—besides himself.

BOILER SCALE

Continued from page 95

though hard, has a chalky nature. Both are a white deposit.

Typical boiler scale, though, scarcely ever consists of just one compound. You'll find it a combination of several, or even all of them. What's more, the crystallized salts rarely exist in their simple forms alone. As boiler pressure goes up they display an even greater tendency to unite into various intricate formations, so intricate you need an exact analysis or X-ray techniques to identify.

Sometimes these scales entrap other boiler-water precipitates, like the colloidal suspensions of silica and aluminum compounds. These compounds can produce some of the worst scale types, the complex alumina-silicates. Then, too, you're apt to find magnesium hydroxide and iron oxides included.

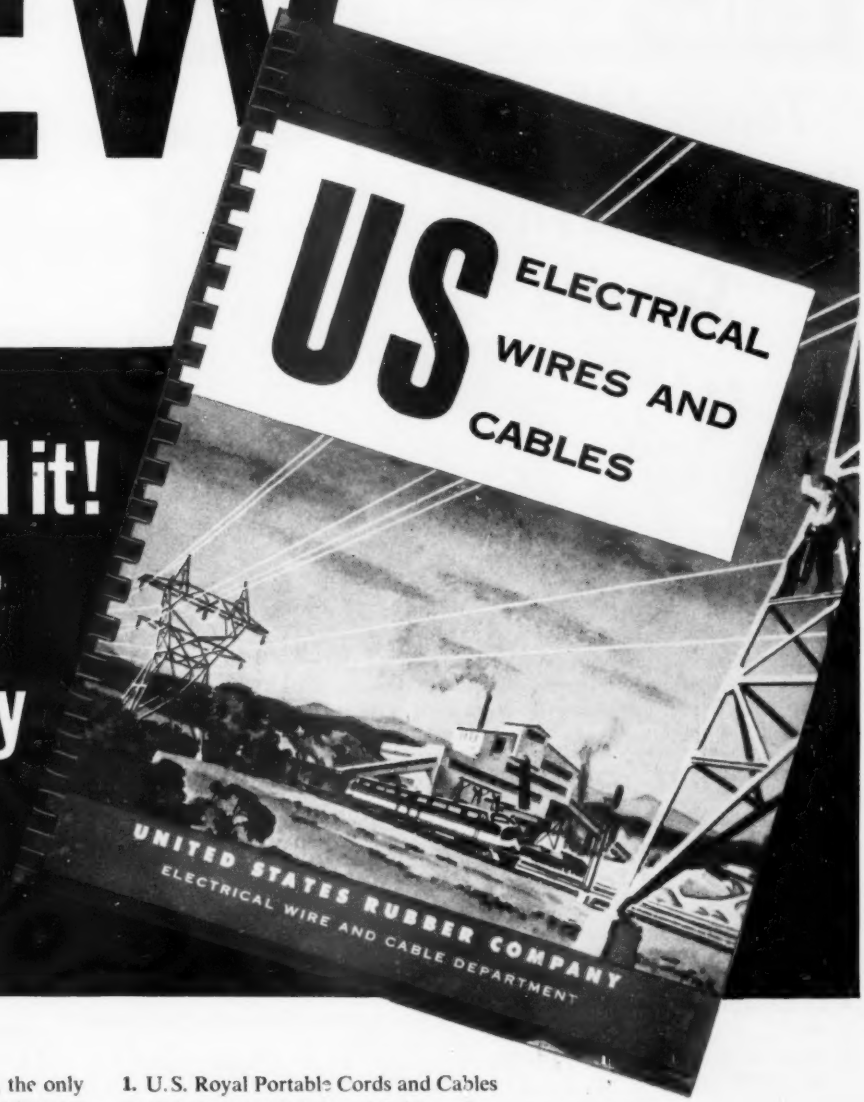
The greater the silicate content in a scale's composition, the more adherent, insulating and tough the deposit is.

SUPERSATURATION

How about the scales that develop in the steam-generating sections of a boiler, like the areas exposed to the furnace's radiant heat, the waterwalls and foremost banks of tubes in a watertube unit, and the lower, front sector of the shell, and the water legs of firetube designs?

The chemical procedures of crystallization — decomposition, dissociation, concentration, mass action — continue working, but there are intermediate

NEW



You need it! Send for free copy today!

United States Rubber Company, the only electrical wire and cable producer to grow its own natural rubber and to manufacture its own plastics and synthetic rubber, makes a complete line of electrical wires and cables for every industrial and domestic application. Just published is the 1953 "U.S." Catalog, essential for men who specify, install or maintain electrical wire and cable. Send for your free copy to address below. Here are the catalog chapter headings:

1. U.S. Royal Portable Cords and Cables
2. U.S. Railroad Wires and Cables
3. U.S. Power Cables
4. U.S. Control and Signal Cables
5. U.S. Building Wires and Cables
6. U.S. Bare and Weatherproof Wires
7. U.S. Flexible Cords and Cord Sets
8. U.S. Telephone Wires and Cables
9. Miscellaneous U.S. Wires and Cables
10. Technical Data

"U.S." Research perfects it...
"U.S." Production builds it

U.S. RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE AND CABLE DEPARTMENT • Rockefeller Center, New York 20, N. Y.

EVERLASTING
Boiler Blow-off Valves...

Teamed Up For "EVERLASTING" Service

The unique service qualities of EVERLASTING Blow-off Valves have long been demonstrated in boiler-rooms throughout the country. Now their superior design features have been teamed up in these EVERLASTING Duplex Blow-off Units.

HERE'S WHAT YOU GET WITH THESE DUPLEX UNITS

Valve shown on left of unit

- Lever- or wheel-operated types—as you desire
- Unrestricted flow — straight-through
- Rotating sliding disc—self-grinding, self-lapping
- Drop-tight seal—improving with use
- Non-wedge action — no sticking, no jamming

Valve shown on right of unit

- Straight-way or angle types to select from
- Strength to withstand repeated shock of blow-off force
- Exceptional resistance to erosion, abrasion and rust
- No pockets to permit lodgment of solids
- Positive action, self-cleaning

Not only do these EVERLASTING Duplex Blow-off Units provide an absolutely drop-tight seal — they are so constructed that long and repeated operation will not affect this tightness. Other Duplex Units for varied requirements are shown in our Bulletin.

Either valve of any EVERLASTING Duplex Unit can be supplied separately. But for boiler blow-off applications, any one of the complete EVERLASTING Duplex Units assures absolute safety — at low maintenance cost.

Ask your distributor — or write directly to us — for complete information.

EVERLASTING VALVE CO., 49 FISK STREET, JERSEY CITY 5, N. J.

EV 328A

Everlasting Valves

Trade-Mark "EVERLASTING" REG. U.S. PAT. OFF.

for everlasting protection

BOILER SCALE

Continued from page 192

physical steps involved, Fig. 6.

Temperature of the water film lining the metal surface runs higher than that of the main fluid. So evaporation takes place there first. As a steam bubble emerges, then rapidly expands, it pushes all its dissolved solids into the thin fluid shell surrounding it. Result is a highly concentrated, thickening, heavy liquid that collects around the base of this steam bubble. Once the steam bursts free of its liquid shell, it leaves behind a ring of strong solution.

A fresh film of water comes along and pushes this fluid ring into the main stream. Action is a scrubbing one that washes away the strong solution rings. But the effectiveness of this washing action depends on the degree of understanding of each of its dissolved compounds and the speed at which steam bubbles are forming. As the main stream or washing body grows more concentrated its diluting powers diminish.

Even while this process is going on in the main stream, that portion of salts contained in the water film next to the metal will reach its solubility limits much faster. Chief reason is the film's higher temperature. Solubility of the principal scale-forming salts decreases with a temperature rise, and so these compounds become supersaturated in the steam bubbles' fluid shells. The fluid ring leaves precipitates behind on the metal surface, and at a faster and faster rate. The main stream's washing action has been weakening all along. When it fails to keep pace with the fluid shell's rate of precipitation, some or most of the dissolved salts do not redissolve. A succession of ring deposits unites the crystal and later fuses into scale, solid, continuous.

STARVATION

Quite a different experience forces the highly soluble sodium and potassium salts out of solution, namely starvation. An impeded water circulation sets the stage, something like a heavy sludge accumulation, in a waterwall header or tube bend, could produce. Water supply drops below the rate needed to replenish the rapid evaporation losses. Water vaporizes to near dryness compelling the sodium and potassium compounds to crystallize out. They fuse into a hard scale, slow to redissolve. Any extended delay on returning this deposit into solution leads to local overheating of the tube and its eventual failure from blowout.

CARRYOVER

Last of the five ways scale forms on metal surfaces, carryover is a direct

Visit the Tycol Exhibit!
American Society of Lubrication Engineers
Hotel Statler, Boston, Mass.
April 13-15

...with TYCOL lubricants on hand!

Take heavy mechanical equipment, for instance. There's a Tycol lubricant for any application you name: For instance, what about steam turbines? . . . Tycol Aturbrio oils resist heat and sludging, are "double inhibited" to provide the utmost resistance to rust and oxidation. Diesels? . . . Tycol Adelbus oils contain additives that produce a tough "film of protection" and help to eliminate sludge and varnish. You always get top performance with Tycol lubricants. Why? . . . Because each Tycol grease and oil is manufactured from high quality base stocks and *tailored* for a specific application. Get the full story of the entire Tycol line from your local Tide Water Associated office today!

Over 300 Tycol industrial lubricants are at your disposal . . . engineered to fit the job!

REFINERS AND MARKETERS OF VEEDOL . . . THE WORLD'S MOST FAMOUS MOTOR OIL

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
Philadelphia • Chicago • Detroit
Tulsa • Cleveland • San Francisco
Toronto, Canada

TIDE WATER ASSOCIATED OIL COMPANY
11 BATTERY PLACE · NEW YORK 4, N.Y.

SPIRALWOUND

World's Most Popular Type Metal-Asbestos Gasket

Spirally wound Type Gaskets deserve their popularity because they offer a built-in resiliency, for safe seals with lighter bolt-loads, that no other gasket type offers.

Ajax Spiralwound Gaskets are made for all standard pipe flanges and for manholes, handholes and tube caps of all makes of stationary and marine boilers, waterwalls, economizers, and other boiler accessories.

They are available in plated low-carbon steel or stainless with fillers of Canadian or blue African Asbestos or chemically inert duPont Teflon.

Ask your Industrial Distributor or write—

UNITED STATES GASKET COMPANY

FABRICATORS OF "TEFLON" & "KEL-F" FOR THE CHEMICAL PROCESS & ELECTRONIC INDUSTRIES

CAMDEN 1 NEW JERSEY

Representatives in Principal Cities Throughout the World

BOILER SCALE

Continued from page 194

result of too wet a steam leaving the boiler drum. An overburdened boiler, inadequate mechanical facilities, abnormally high water concentrations can all bring on spasmodic priming or a continous carryover of water into steam areas. Often a boiler lacks adequate purifying equipment for these conditions. Boiler-water droplets carried over evaporate along the steam passages and leave their scale-forming deposits behind. Superheater or equalizing tubes fail for this reason.

A little soluble sodium silicate in the boiler water tends to hydrolize into sodium hydroxide and silicic acid, Fig. 4. The latter is an insoluble, colloidal product. At fairly high temperatures this colloidal acid volatilizes with the steam and its carryover increases with rising temperatures and soluble silica concentrations in the boiler water. Silicic acid becomes more noticeable at operating pressures above 600 psi. But with excessive silica concentrations the acid occasionally carries over as low as 400 psi.

In a well superheated steam this acid is harmless. But as the steam expands in the late stages of a turbine, the acid condenses out on the blades to leave a water-repellent, glossy and extremely sticky mass that greatly decreases turbine efficiency. You have to resort to a caustic soda bath to remove it.

AIR POLLUTION

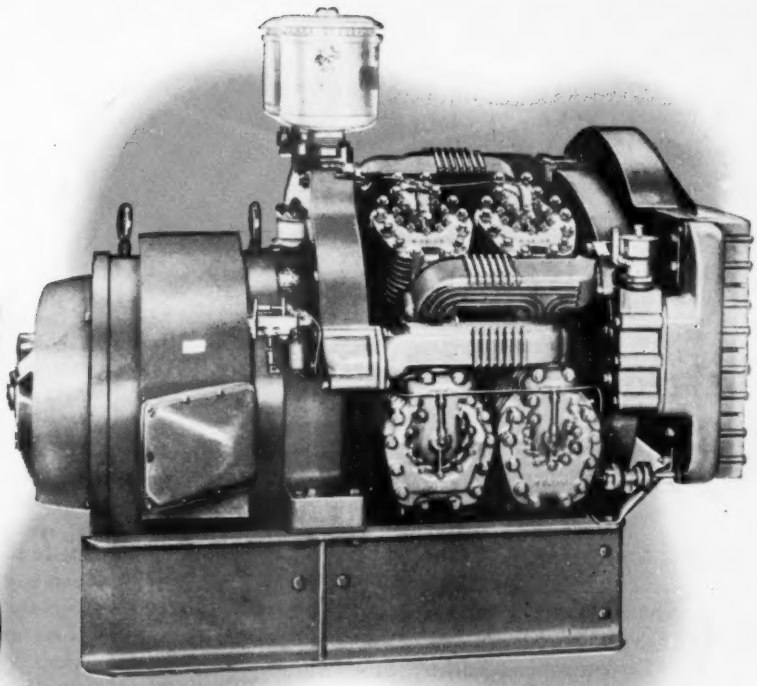
Continued from page 76

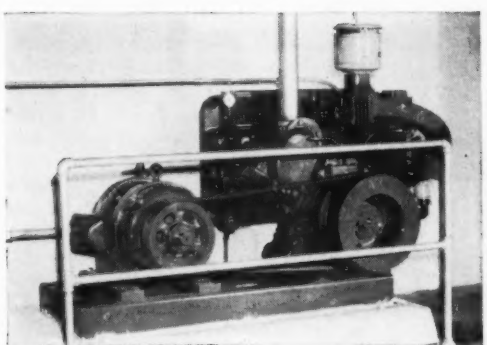
with pulsating rather than with direct voltages. Further, the highest possible peak voltages on discharging electrodes produce the best results, Fig. 3. But backing up these peak power surges must be an adequate transformer and rectifier capacity. What's more, the higher the applied voltages, the more bus sectionalization becomes attractive. With greater sectionalization two major advantages develop: (1) Whatever troubles appear are isolated. (2) Fields of electric energy through which the gas passes are more uniform.

Contrary to earlier ideas, peak collection efficiency comes from setting the precipitator voltages high enough to produce sparking, about 100 sparks per minute per precipitator section.

New designs meet this requirement as fully as possible. Current and voltage ratings of rectifier sets, commonly used for flyash applications, are 150 to 300 mva, and 70 to 100 kv. Power inputs may run up to 9 kw for 100,000-cfm gas flows to achieve a 97% collecting efficiency. Exact peak-voltage values

JOY WL-80 COMPRESSOR with automatic start and stop control





JOY COMPRESSORS **meet any need!**

Air-cooled or heavy duty water-cooled; complete range from 1.4 to 8800 CFM, ¼ to 600 HP.

A Real "Package-Unit"

Joy WL-80's are ideal for the smaller air-requirement jobs, or for de-centralized air supply, etc. These two-stage, air-cooled units are delivered ready-to-go, complete with air receivers, piping and wiring if you wish—just hook them up to power and air lines. Extremely compact and efficient, a WL-80 will fit into any small corner of your plant. You can eliminate long runs of piping; compress the air right where you use it. Available in eleven sizes from 15 to 125 HP, 81 to 641 CFM, with pressures to 125 PSI, for service indoors or out. ● *Write for Bulletin A-56.*

Joy also makes a complete line of Oil-Free Compressors for applications where air must be free of any lubricant. *Write for details.*

Consult a Joy Engineer

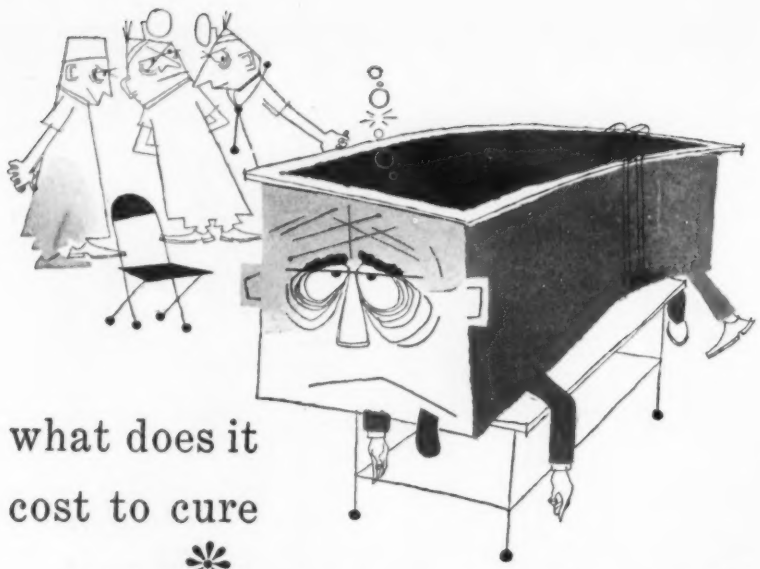
Over 100 Years of Engineering Leadership

W&D 1 4080

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO



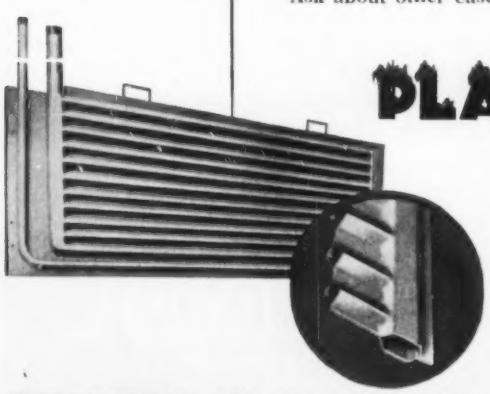
what does it
cost to cure
✻
coil-itis in your processing tank?

The constant care it takes to keep tanks operating when they're plagued with coil-itis is extremely costly. Downtime, and all the other maintenance time, slow heating and cooling ills of using old-fashioned pipe coils can be cured with Platecoils. As revolutionary as the new wonder drugs, Platecoils save as much as 50% in initial cost. They take 50% less space in the tank. They simplify maintenance and save hours of downtime. Compared to the hours it takes to clean and replace pipe coils, Platecoils can be cleaned and replaced in no time at all . . . without dumping the solution. It costs less to cure coil-itis with Platecoils than to suffer its evils. **Write for bulletin P79 today!**

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS COST LESS TO BUY, INSTALL, MAINTAIN

The Newcomb-Detroit Co., Grand Rapids Division, has found it is less costly to buy, install and maintain Platecoils than to fabricate pipe coils in their own plant. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

✻

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, KOLD-HOLD MANUFACTURING CO., LANSING 4, MICHIGAN

AIR POLLUTION

Continued from page 196

depend on precipitator size flue-dust concentration and resistivity. Too high a setting brings an excessive sparking and attendant losses that reduce performance.

Because of these sparking conditions in the precipitator some form of current-limiting impedance or an equivalent device has to go in the circuit to prevent tripping out of rectifier sets from heavy currents and line surges during spark-over. Automatic voltage control, another new development, has solved this problem by maintaining just the right sparking rate so high-efficiency performance remains steady, Fig. 9. The precipitator voltage is held at its optimum value by a spark-counter and a feedback circuit through the automatic voltage control.

Effective Energization. In the fundamental theory of electrostatic precipitators, covered above, one essential of good performance was establishing and maintaining the proper degree of electrical energization. Much recent research has been directed toward improving and stabilizing electrical energization. These studies have investigated the relationship between the magnitudes of the charging field and the collecting or precipitating fields, as influenced by both the properties of the corona discharge and the type and adjustment of the energization equipment. Out of it has come pulse energization, a basically new way to supply high-voltage power to precipitators.

This method employs a high-voltage high-power pulse-generator capable of supplying high-voltage pulses of about 100 microseconds duration at a frequency of several hundred pulses per second. Pulse output may be commutated to as many as four or even six precipitator sections. Several basic advantages, as compared with conventional rectifier-energization methods, develop: higher precipitator efficiency; greater degree of electrode sectionalization, with its more-even-strength electric fields; higher peak voltages through adjustment of pulse frequency and wave shape to fit individual precipitators; inherent current-limiting action.

WITH OUR READERS

Continued from page 5

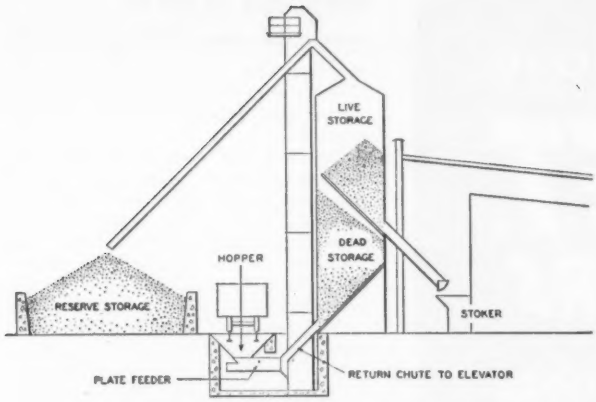
Care and Right Lube Oil Chase Air-Compressor Fires").

I am always surprised in reading about air-compressor lubricants to find no mention of detergent oils. We have found them so satisfactory that we almost insist on their use.

This entire article seems to talk about

COAL HANDLING

From Track Hopper To Bunkers or Storage AT LOW COST PER TON with JEFFREY EQUIPMENT

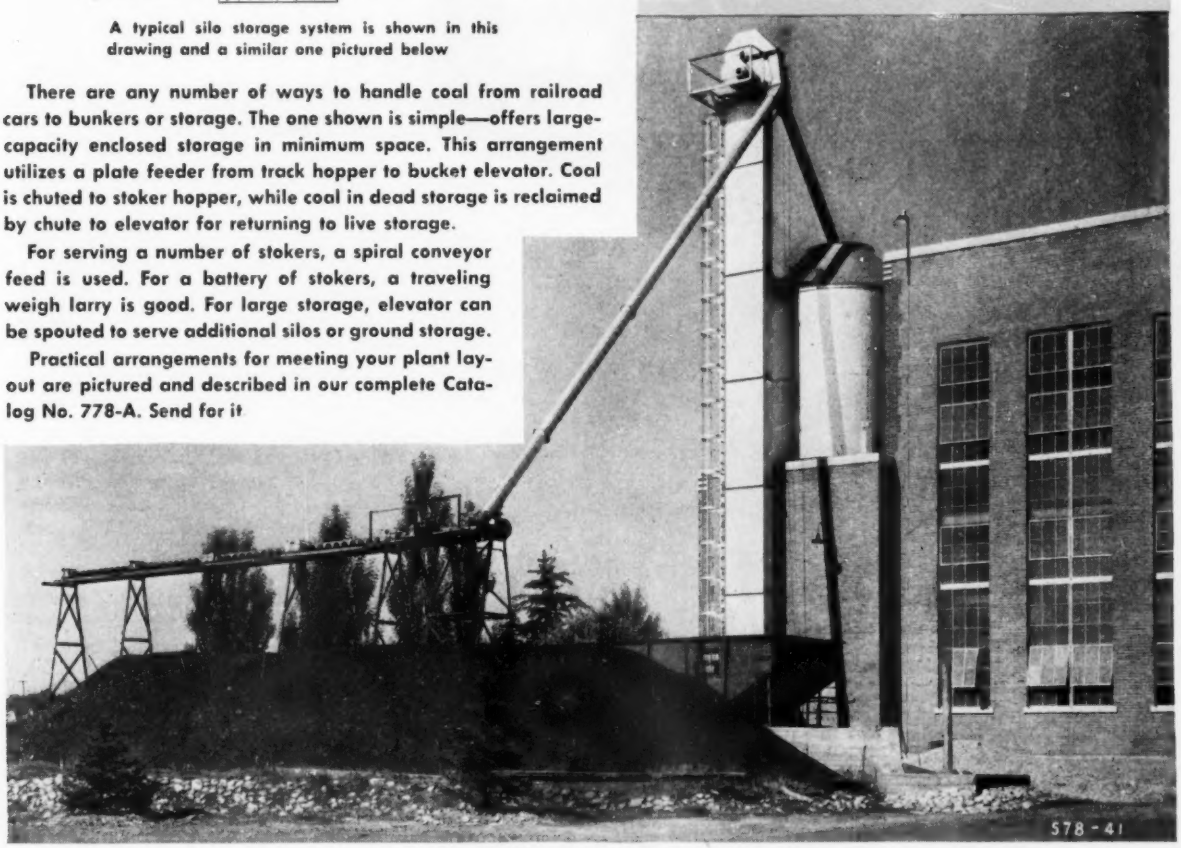


A typical silo storage system is shown in this drawing and a similar one pictured below

There are any number of ways to handle coal from railroad cars to bunkers or storage. The one shown is simple—offers large-capacity enclosed storage in minimum space. This arrangement utilizes a plate feeder from track hopper to bucket elevator. Coal is chuted to stoker hopper, while coal in dead storage is reclaimed by chute to elevator for returning to live storage.

For serving a number of stokers, a spiral conveyor feed is used. For a battery of stokers, a traveling weigh larry is good. For large storage, elevator can be spouted to serve additional silos or ground storage.

Practical arrangements for meeting your plant lay-out are pictured and described in our complete Catalog No. 778-A. Send for it



THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED

. . .IT'S A JOB FOR JEFFREY!

From Head to Hose

ROTOJET®

TUBE CLEANERS

Give you more

POWER, SPEED

DURABILITY

★ Rotojet Tube Cleaners, from head to hose, are tailored to meet individual requirements.

★ Roto Swing-frame Heads, pioneered by us, are the most durable and efficient for finish cleaning. A wide variety of heads and brushes with individually replaceable wearing parts reduce costs materially.

★ Roto Universal Joints combine strength with special protection against wear and vibration.

★ Rotojet Motors operate with air, steam or water. They clean tubes ½" ID up to large pipes faster than any cleaner we ever made. The rugged, efficient Rotojet Motor has only two moving parts.

★ Special Roto Operating Hose withstands abusive twisting, pulling, and abrasion.

★ From head to hose Rotojet gives you the best combination for a fast, thorough job.

SEND FOR NEW ROTOJET BULLETIN

ROTOJET Water-driven Motor Model 321 with swing-frame head and universal joint for 2½"-3" I.D. curved tubes.

ELLIOTT COMPANY-ROTO DIVISION

153 SUSSEX AVENUE NEWARK 1, N. J.

WITH OUR READERS

Continued from page 198

the horizontal slow-speed compressor, although it does not specify, and what is good for one type of compressor is not good for another.

I was surprised to see any mention of carbon monoxide in air compressors. I would like to have a little more light on this.

Finally, we are always happy to see articles on air-compressor maintenance and the proper uses of compressed air. Everything about the making and use of compressed air is so simple, yet so mysterious to most people. Let's keep up the good work.

West Chester, Pa. G B COMFORT
Asst Sales Manager, Schramm, Inc.

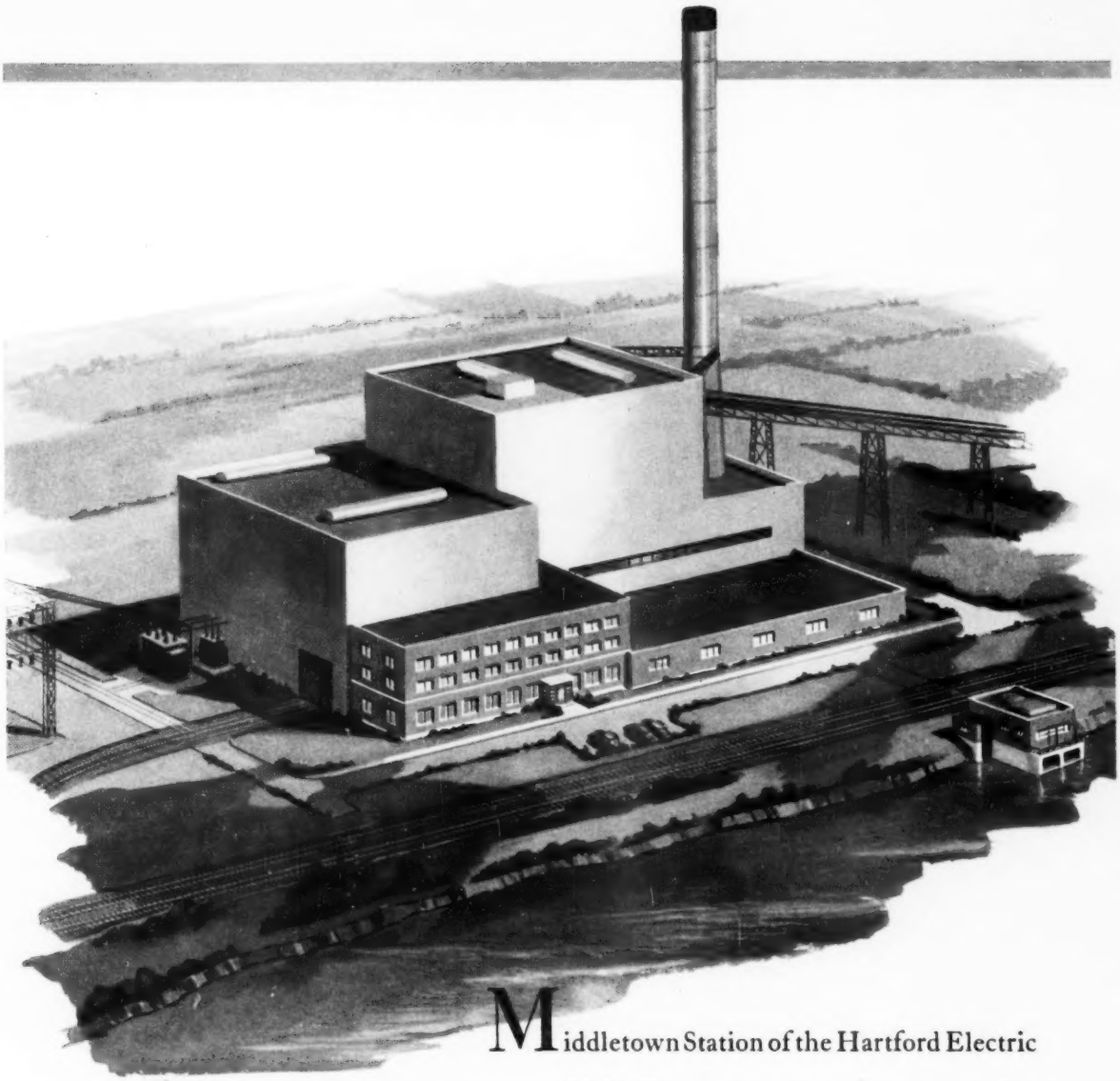
Gas Turbine Course at University of Michigan

An intensive two-week course in gas turbines has been scheduled from June 29 to July 10 by the Dept of Mechanical Engineering of the University of Michigan. It is designed particularly for engineers in industry, professors contemplating courses in gas turbines, and members of the armed forces having a direct interest in gas turbines.

Twenty one three-hour morning and afternoon sessions will cover: Thermodynamics of Gas Turbine Cycles; Thermodynamics of Propulsion, Rockets, Ram Jets, etc; Thermodynamics of Gas Flow; Centrifugal Compressor Design (two sessions); Performance Charts and Testing Techniques; Axial Compressor Design (two sessions); Axial Turbine Design (two sessions); Radial Inflow Turbine Design; Heat Exchangers; Combustion; Afterburners; Stresses in Blades and Discs; Fuel Systems; Materials; Governing; Fuels; Application to Vehicles and Aircraft.

A fee of $100 (payable by May 1, 1953) will cover tuition and a set of notes for the course. Since number of students will be limited to sixty, registrations will be accepted in the order of submission. Registration and requests for information should be sent to Frank L Schwartz, Professor of Mechanical Engineering, 231 West Engineering Building, University of Michigan, Ann Arbor, Michigan.

Better than a trillion kilowatthours of electricity are now being produced annually by all the world's generating plants, and 42½ per cent of this staggering total is generated by the United States, four times the output of second-ranking Societ Russia, according to the 1952-53 edition of "I Want to Know About the Electric Industry," a booklet just published by the Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.



Middletown Station's initial generating unit, scheduled for operation early in 1954, will add 60,000 kilowatts to Hartford Electric Light Company's capacity. The station is planned for future expansion to a total of six units.

Middletown Station of the Hartford Electric Light Company, now under construction at Middletown, Connecticut, is another major design and construction job for this client since 1920.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

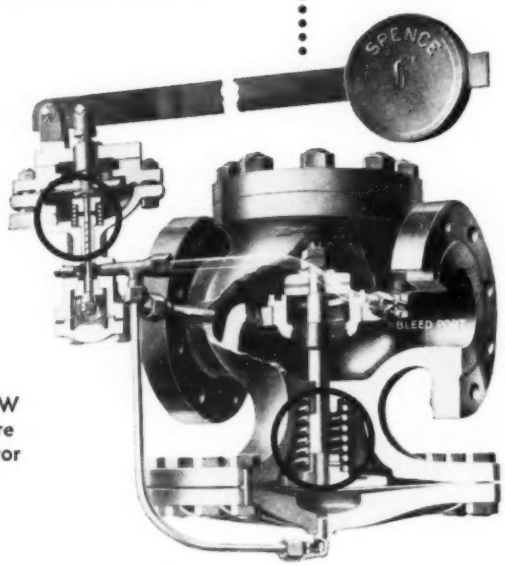
HOW SPENCE DESIGN...

...*protects springs*

FOR LONGER LIFE

In the Spence Regulator, the springs are out of the path of the steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life. This is only one of the many Spence design features that assure dependable, accurate regulation year after year. That means less down-time, less time and money wasted on replacement of parts.

Spence makes a wide line of automatic regulating valves: Pressure, Temperature, Differential Pressure, Back Pressure, Pump Governor and many other types. Write for bulletin 100 giving full details.



Type EW
Pressure
Regulator

A few other design features:

SECO METAL SEATS AND DISCS— Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

LARGE BALANCED METAL DIAPHRAGM located in a cooled zone with a condensate seal above and below it, never has to be replaced under normal conditions.

PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . reduces valve stem wear and eliminates time-consuming maintenance.

Spence

SPENCE ENGINEERING COMPANY, INC.

WALDEN, NEW YORK

SE123

ECLIPSE FUEL ENGINEERING WRITES:

"Heat Prover Completed a 30 Hour Burner Test In Just 6 Hours!"

Amazing Cities Service Heat Prover Works 5 Times As Fast As Old Method... More Accurate, Too!

Robert W. Pixler, Laboratory Supervisor for Eclipse Fuel Engineering Company, Rockford, Illinois writes:

"It did not seem possible that an instrument that is so fast and direct-reading could possibly have the accuracy we demand. But, we found the Heat Prover equally exact, possibly even more exact, than standard commercial testing equipment.

"Our test work with previous instruments was a long, drawn-out affair. But with the Heat Prover, we completed what would normally have been a 30-hour test in just 6 hours! ...and we doubt that our old equipment could have maintained the accuracy delivered by Cities Service Heat Prover."

WHEREVER A FURNACE OPERATION IS INVOLVED, the Heat Prover can help increase productivity by providing:

- **Rapid, continuous sampling**
- **Simultaneous reading of oxygen and combustibles**
- **Direct measurement of oxygen and combustibles**
- **Easy portability**
- **No maintenance; no re-calibration**

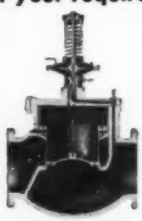
For details, contact nearest Cities Service office or write Cities Service Oil Company, Dept. D16, Sixty Wall Tower, New York City 5, N. Y.

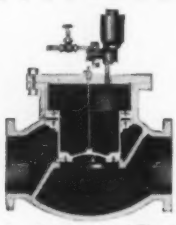
CITIES SERVICE

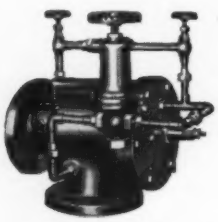
QUALITY PETROLEUM PRODUCTS

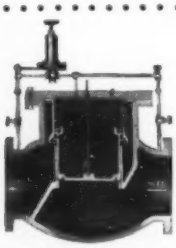
Immediate Shipment From Stock
On Many Sizes
GOLDEN-ANDERSON
Cushioned
Steam and Water Pressure Valves
One of these eight valves will ideally meet your requirements

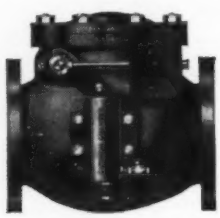
Single-Acting Non-Return Valve

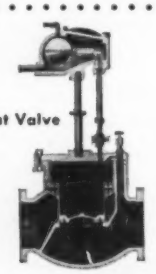

Altitude Control Valve


Solenoid Operated Electric Water Service Valve


Surge Relief Valve


Water Pressure Reducing Valve


Swing Check Valve


Cold Water Float Valve

Triple-Acting Non-Return Valve

Our descriptive bulletins covering these various valves gladly sent on request.

GOLDEN ANDERSON Valve Specialty Company
2070 KEENAN BUILDING • PITTSBURGH 22, PA.

More POWER NEWS

Begins on page 150

ment between the companies will entail the Americanization of Swiss designs and the establishment of sales and service organizations in this continent by Cleaver-Brooks.

The venture is the result of mutual interest and cooperation between the two companies in such fields as compressor development for heat-pump evaporators and research in the concentration and disposal of spent sulphite liquor in paper mills.

To handle expanded production, Cleaver-Brooks is pressing new construction at its main plant at Holton and Keefe to include about 50,000 sq ft of factory space and extensive tooling.

Oil & Gas Power Div. ASME, to Hold Anniversary Conference

The Oil and Gas Power Division of the American Society of Mechanical Engineers will celebrate a silver anniversary this year in conjunction with its 25th annual conference and exhibit to be held at the Schroeder Hotel in Milwaukee, Wis., May 25-28. The session is open to everyone interested in diesel, dual fuel and gas engines and will feature refreshers on design, operating and maintenance developments. Added attractions include fifty exhibits of engines and accessories and several inspection trips.

Among the technical papers to be presented will be: "Valves for High Output Engines", "Two and Four-Cycle Test Results of Medium Speed Engines on Heavy Fuel", "The Tuned Manifold, or Supercharging Without a Blower", "Residual Fuel Production and Utilization in Diesel Engines" and "Crankshaft Notes, Particularly Crankwebs."

World's Largest Network Analyzer

Contracts have been signed with seven major power companies in Pennsylvania, New Jersey and Delaware for the installation of an ac Network Analyzer in the industrial research laboratories of The Franklin Institute. The $400,000 analyzer is being built by the Westinghouse Electric Corp, and will be installed in a specially-fitted room atop The Franklin Institute by mid 1954.

The analyzer is actually a power system in miniature, with a typical scale factor of 1 to 100,000. Its maze of circuits represents generators, transmission lines, transformers and loads. In minutes, or hours at most, the operator can connect (by means of patch panels) these elements in imitation of any given power system. By metering current,

DREW TECHNICAL BULLETIN

DREW ORGANIC U-14-L

Antifoam, Sludge Conditioner and Stabilizer

Used in conjunction with conventional inorganic water treatment to:

a) Provide protection against carryover
b) Prevent sludge from adhering to boiler metal surfaces
c) Prevent deposits in pre-boiler section

DREW ANTIFOAM PREVENTS CARRYOVER

Anything other than dry steam going over from the boiler may lead to difficulties in boiler water systems. Drew Boiler Water Treatment includes highly effective products such as Drew Organic U-14-L for prevention of carryover.

A large food manufacturer in the mid-west was troubled with excessive carryover. Drew Organic U-14-L was recommended after a thorough analysis. It not only stopped the carryover, but also cleared up sludge adherence, which had long been a problem.

To prevent or eliminate industrial water problems in your plant, you'll get results faster and more economically with this Drew program:

1. Thorough study and analysis of the problem
2. Use of effective organic and inorganic products
3. Efficient methods of feeding products to the system
4. Control of dosages by simplified plant testing
5. Service by qualified field engineers
6. Technical assistance by the Drew Technical Department

Write for booklet "Drew Organics" and technical bulletins.

Power Chemicals Division

E. F. DREW & CO., INC.

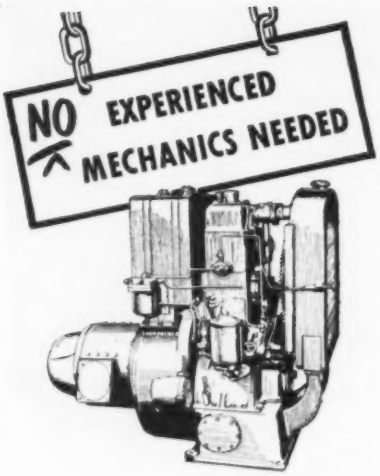
15 East 26th Street, New York 10, N. Y.

AJAX, ONTARIO

SAN FRANCISCO CHICAGO PHILADELPHIA BOSTON DALLAS ASHEVILLE, N. C.

Service throughout the United States, Canada and South America

DREW PRODUCTS



. . . NORDBERG DIESEL ENGINES are easy to operate—simple to maintain

You just don't need special mechanical training to operate and maintain Nordberg "4FS" Diesel engines.

Their basic design and construction makes them easy to start and easy to keep going—day in, day out, with a minimum of attention. Routine maintenance is extremely simple . . . all parts are easy to get at.

These are reasons why Nordberg 1, 2 and 3-cylinder "4FS" Diesels are more and more in demand for all kinds of power jobs from 10 to 45 hp—for electric service from 6 to 30 kw (6,000 to 30,000 watts)—and for pumping jobs from 200 to 3000 gpm at 15 to 240 ft. total head.

Mail the coupon for full details.

NORDBERG MFG. CO., Milwaukee, Wis.

NORDBERG
BUILDERS OF AMERICA'S LARGEST LINE OF HEAVY-DUTY DIESELS

MAIL THIS COUPON TODAY

Nordberg Mfg. Co., Milwaukee, Wisconsin

Send catalog covering Nordberg Type 4FS Diesels. I am interested in a unit for the following service:

Your Name_____

Company Name_____

Address_____

City_____ Zone____ State_____

4-253

More POWER NEWS

Begins on page 150

voltage and power at any point in the system, he can discover how the full-scale system works (or will work, if it has not yet been built), and how it might be modified to give maximum service. He will be able to solve nearly any problem concerning the design or operation of a system: transient and steady-state stability, load control, voltage regulation, relay application, etc.

The analyzer will incorporate 580 circuits in two separate units, one having one-third, the other two-thirds of the total capacity of the device. Each unit can operate separately or both together if the problem demands.

World's First All-Gas Turbine Tanker Ordered

London—(*McGraw-Hill World News*)—The first order for a tanker propelled exclusively by gas turbines has been placed by the Anglo-Saxon Petroleum Co, Ltd, operators of the Shell Tanker Fleet.

A single screw vessel of 18,000 deadweight tons, it is scheduled to be completed in 1956. It will be one of the "general purpose" class of tankers of which 50 are either on order or under construction for the Shell Fleet. The others will be powered by either steam-turbine electric machinery or by geared steam turbines, so that a direct comparison of the operating and maintenance costs of the three forms of propulsion will be obtained.

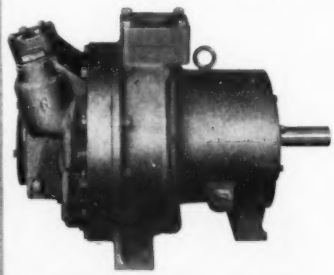
The first success was achieved in 1951 with the tanker *Auris* which became the world's first merchant ship to be powered by a gas turbine engine, fitted in place of one of the ship's four diesel engines. It functioned so well that it propelled the *Auris* across the Atlantic in early 1951 without any help from the diesel engines which were held in reserve.

The machinery will comprise two gas turbo-generators driving the single propeller shaft through two electric motors and a two-pinion single reduction gearbox. Power for all auxiliary requirements at sea and in port will be drawn from the propulsion gas turbines, including that required for the 2,000 ton per hour cargo pumps. A diesel generator will be provided to supply power for ship's services when the gas turbines are not in use.

Operating on the open cycle, each unit will have two-stage compression with intercooling. The h-p line will comprise turbine, compressor and geared auxiliary generator with exciter set; the l-p line will comprise turbine, compressor and propulsion generator.

For QUALITY *Specify* PYLE-NATIONAL **Turbines**

¼ to 120 h.p.



The Pyle-National line of highly efficient impulse type turbines is ideal for dependable mechanical drive of small machinery such as pumps, fans, blowers, stokers, abrasive wheels, agitators, and generators particularly where the exhaust steam can be used for heating and other purposes.

Since 1897 Pyle-National has manufactured their turbines entirely within their own plant . . . thus assuring positive control of quality and workmanship through all stages of production . . . from raw material to the final testing.

SEND NOW FOR BULLETINS containing complete information on these small and medium capacity turbines.

TURBO-GENERATORS

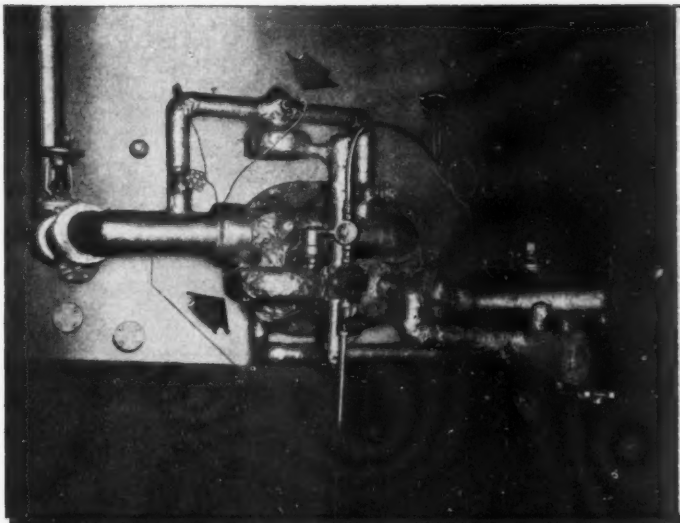
Also available is bulletin on Pyle-National turbo-generators (500 to 15000 watts).

The Pyle-National Company

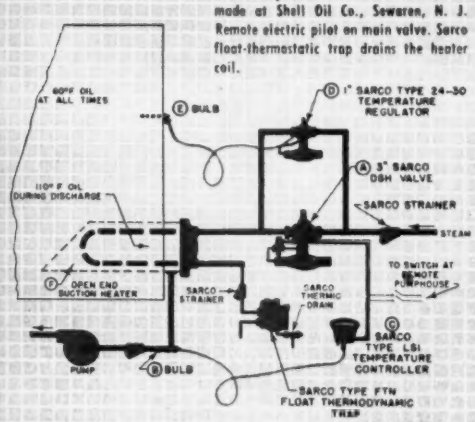
1387 North Kostner Avenue
Chicago 51

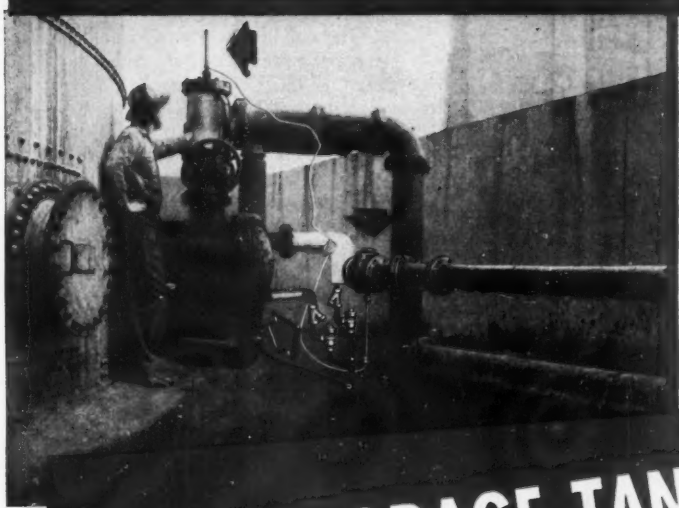
SINCE 1897

FLOODLIGHTS and PYLETS

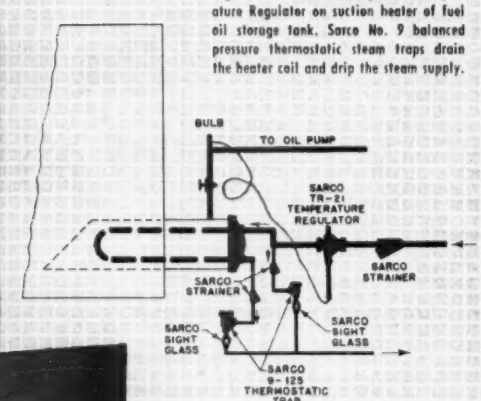


● Fig. 1, Sarco type 24-30 self-contained, pilot-operated Temperature Regulators on bulk storage tanks. One of 13 installations made at Shell Oil Co., Sewaren, N. J. Remote electric pilot on main valve. Sarco float-thermostatic trap drains the heater coil.





● Fig. 2, Sarco TR-21 self-operated Temperature Regulator on suction heater of fuel oil storage tank. Sarco No. 9 balanced pressure thermostatic steam traps drain the heater coil and drip the steam supply.



BULK STORAGE TANKS

● SUCTION HEATERS, as widely used to bring heavy fuel oil in bulk storage to pumping temperature, require *fast acting* temperature control. All the controlling must be done while the oil is drawn off through the heater.

The control valve must be of the dead-end, *tight shutoff* type to prevent running away of the temperature when no oil is pumped out.

Sarco self-contained, pilot operated regulator, type 24-30, (Fig. 1) meets these requirements perfectly and will hold delivered fluid temperature constant within close limits.

Fig. 2 is a simplified hook-up for low pressure steam, using self-operated regulator, type TR-21

Send for a Questionnaire or write for Catalog 600-14, to Sarco Company, Inc., Empire State Bldg., New York 1, N. Y. Branches in principal cities. Sarco Canada Ltd., Toronto 8, Ont.

Sarco self-operated Temperature Regulator, type TR-21, sizes ½" to 8", for low pressure steam.

Sarco pilot-operated Temperature Regulator, type 24-30 for dead-end service and high steam pressure.

A Sarco pipeline strainer should be ahead of every regulator to keep out dirt and scale.

SARCO saves steam

improves product quality and output

418

for 32 years...

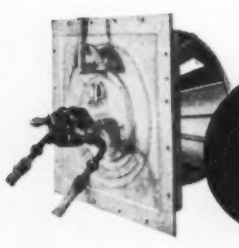
the nameplate of efficiency

PEABODY BURNERS FOR INDUSTRY—

Since 1921 Peabody Burners have served industry throughout the world, and continual research and development have maintained Peabody as the leader wherever reliable, efficient operation is important.

If you have a combustion problem involving commercial liquid, pulverized or gaseous fuels or by-product fuels such as blast furnace gas, refinery sludges and sawdust, look to Peabody for custom-engineered efficient and economical equipment. Combined Burners to fire two or more of these fuels are available.

Write for complete set of Peabody Bulletins. No obligation.



PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

OFFICES IN PRINCIPAL CITIES 767
PEABODY LIMITED • LONDON, S.W.1, ENGLAND

More POWER NEWS

Begins on page 150

Army Engineers To Purify Area Water

Some of the nation's most strategic waters, partially contaminated by industrial and domestic waste, will receive purification treatment from a mobile water purification unit developed by the Army Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Virginia.

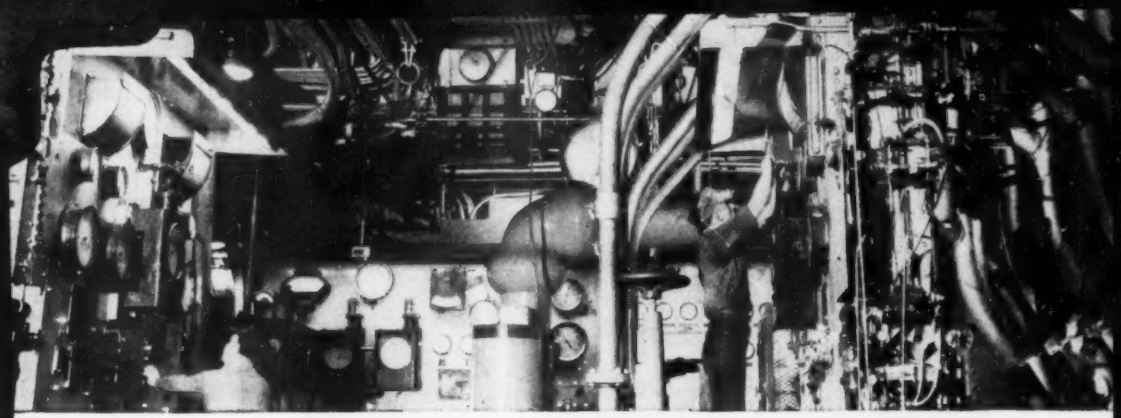
The 10 week itinerary includes stops at Laketown, Utah; Fort Knox, Kentucky; and Rock Island, Peoria, Springfield and Cairo, all in Illinois. The waters scheduled for testing are Bear Lake, Lake Springfield, the Mississippi, Illinois, Ohio and combined Mississippi, Missouri and Ohio Rivers.

The mobile water purification unit is truck-mounted and electrically operated. It will treat, clarify, filter and distribute 3000 gallons of water an hour in temperatures as low as 40 degrees below zero. After pumping in polluted water it takes about 20 minutes before drinking water is discharged. One man is required to operate the unit and three can put it into operation in less than 90 minutes.

Water consumption in the United States is roughly estimated at 1000 gallons per day for each man, woman and child. Included in this is water consumed for domestic, industrial and agricultural uses. However, under emergency conditions, where only water for drinking and cooking needs can be considered, one truck-mounted unit would be capable of supplying the curtailed needs of a community of nearly 50,000 people.

Bulletin No. 2368, *Hydro-Electric Progress in Canada*, 1952, the annual review of current water-power developments throughout Canada, and of other construction concerned with power supply and distribution, has been issued by the Water Resources Division, under date of January 1, 1953. The record-high total of 1,064,600 h.p. of new hydro-electric capacity was brought into operation during 1952 and the total installed capacity of hydraulic plants in Canada is now listed at 14,304,230 h.p.

The review outlines each of the numerous individual projects comprising the large program of power-plant construction completed in 1952, also the other developments in various stages of construction or which are definitely in prospect for early construction. It is anticipated that 860,000 h.p. will be completed in 1953, 1,500,000 h.p. in 1954-55, and a further amount in later years. Copies may be obtained free upon application to Chief Water Resources Division, Department of Resources and Development, Ottawa, Canada.



STOP COSTLY PIPE-LINE FAILURES

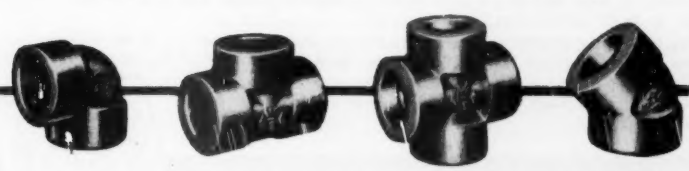
No one knows better than you the increasingly high cost of unscheduled outages due to pipe-joint failures. But do you know just how far it is possible to go toward *eliminating* such failures throughout the life of your piping systems? The answer to this critical problem in production and maintenance costs is FORGED STEEL FITTINGS by the pioneer firm of Watson-Stillman—consultants and suppliers to *all* major industries concerned with pipe joining and maintenance.

Watson-Stillman fittings are FORGED for maximum strength, toughness, and resistance to corrosion, vibration, and shock. More uniformly precise in all dimensions, they are the modern go-between wherever pipes meet permanently.

Leading Refineries, Chemical Plants, Public Utilities, Refrigeration and Industrial Plants throughout the world stay on stream at lowest cost-per-year with the famous Double-Diamond Fittings by Watson-Stillman. Write for literature.

Screw-End and Socket-Weld Types

SOLD THROUGH LEADING DISTRIBUTORS



WATSON-STILLMAN FITTINGS DIVISION

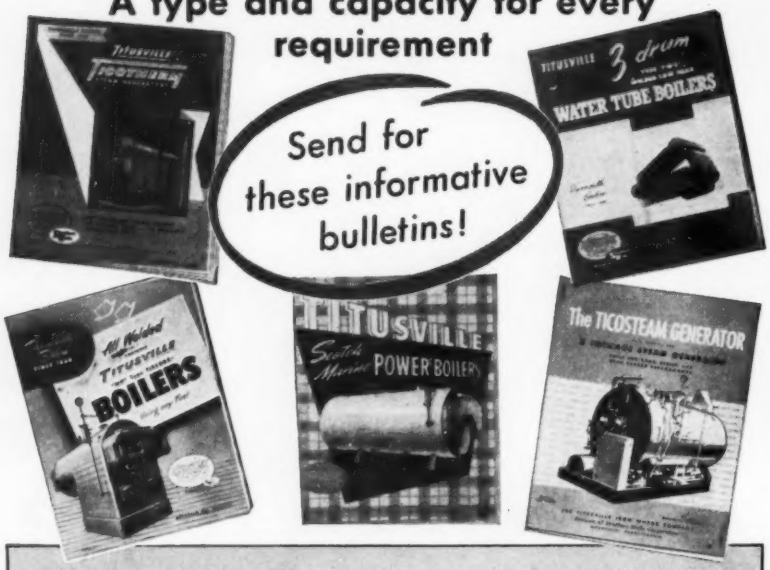
H. K. PORTER COMPANY, INC.

133 ALDENE RD., ROSELLE, NEW JERSEY

9-0-5

Meet the TITUSVILLE Boiler Family

A type and capacity for every requirement



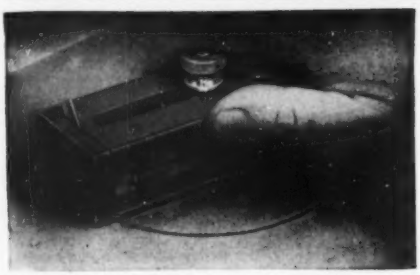
THE TITUSVILLE IRON WORKS COMPANY

a division of Struthers Wells TITUSVILLE, PENNA.

Representatives in Principal Cities

ALLPAX

GASKET CUTTERS



Here's a "MUST" for MAINTENANCE ...providing low cost insurance against high cost shutdowns

With an ALLPAX Gasket Cutter in your plant, you're prepared for any emergency. This CUTTER should be a "must" for you because it can save time, effort and trouble in cutting gaskets quickly, if, when and as you need them . . . from felt, cork, rubber, compressed asbestos sheet, etc. up to ¾" in thickness.

Two types are available: the Cutter illustrated cuts gaskets from ¼" to 48" diameter; a "Junior" size cuts gaskets from ¼" to 6" diameter. Send for the ALLPAX Catalog for further details.

Also: Packings for all services; special packings to order; valve discs; retainer rings; molded and mandrel-cut packing rings; packing hooks.

THE ALLPAX COMPANY INC.

805 Mamaroneck Ave., Mamaroneck, N.Y.

Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

More TECHNICAL BRIEFS

Begins on page 152

parison, the salt concentration in sea water is approximately 2000 grains per gal. *ASME Paper No. 52-A-145.*

Steam Generation

European Practice with Sulzer Monotube Steam Generators. *By Jacques Castpar, Sulzer Bros, Ltd.*

Increasing circulation in steam generators by applying forced circulation and improving control by special additional devices has been much in the minds of boiler engineers.

Steam generators with forced circulation divide into two main groups:

a) drum-type steam generators, in which the forced circulation depends on an additional circulating pump. This system, which requires a boiler drum, was first developed by Lamont and has been applied to other designs with more or less important modifications.

b) drumless-type steam generators on the once-through system in which the working medium, in principle, passes only once through the total tube system. The additional pressure required for forced circulation is provided by the main feedwater pump.

By the end of the last century a few small steam generators of the once-through type had been built. One unit was exhibited by de Laval in Stockholm in 1897. The fundamental principles and conditions which had be to reckoned with were not sufficiently known and analyzed. The regulating and water problems had not been solved satisfactorily and experience with such generators was, at that time, far from encouraging.

In 1926 a boiler of the one-drum type went into service at the Sulzer works in Winterthur. It supplied high-pressure steam at 1,500 psi for about 15,000 hours in all. This installation proved satisfactory in service and also in respect of efficiency. Nevertheless, it was considered doubtful whether the conventional type of boiler with drums and natural circulation, as originally designed for low and medium pressure, was really the best solution in the long run for higher pressures and especially for the very highest pressures, since the value of some of its characteristic features and advantages at least decreased with increasing pressures and steaming capacities, so that under extreme conditions they may even become a handicap.

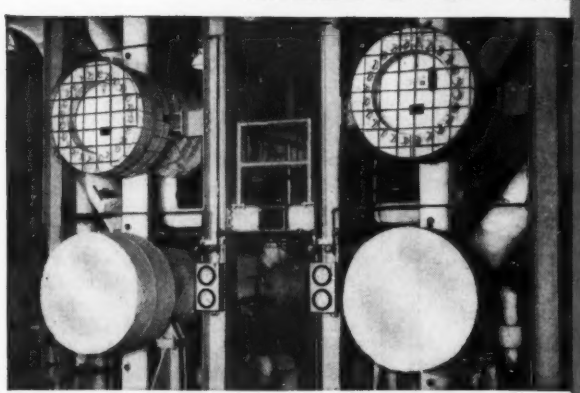
Sulzer Brothers decided to continue their Post World War I investigations in

Directions for ordering papers on p 154

1 Evaporator Condensers
2 Closed Type Feedwater Heaters
3 Condensate Coolers
4 Jacket Water Coolers
5 Lubricating Oil Coolers
6 Evaporators
7 Oil Tank Suction Heaters
8 Fuel Oil Heaters
9 Blowdown Exchangers
10 Aircooled Heat Exchangers
11 Prefabricated Pipe
12 Propane Storage Tanks
13 Large Diameter Water Lines
14 Penstocks

check off your power plant needs

ALCO can meet them



For Example—Feedwater Heaters made by ALCO will meet your most exacting requirements because they have *all* these important features:

1. VIBRATIONLESS, TROUBLE-FREE OPERATION—support plates are of ¾ inch thickness or heavier, with tube holes drilled and reamed to a close fit and edges chamfered. Careful consideration is given to arrangement and spacing of tube supports to guard against vibration.

2. TUBE EROSION PREVENTED—alloy steel impingement baffles, one-quarter inch thick or heavier, are rigidly attached to the tube bundle support structure at points opposite the steam and drip connections to protect against tube erosion.

3. HEAT TRANSFER SURFACE EFFICIENTLY DESIGNED—tube bundles are designed to provide generous escape area and free-flowing distribution of the vapor throughout the shell space. Internal desuperheating and condensate subcooling furnished where required.

4. TIGHT JOINTS ASSURED—in all ALCO feedwater heaters, the tubes are roller-expanded into precision-drilled and reamed tube holes provided with parallel grooves. Full tongue and groove-gasketed joints are standard design.

5. CODES STRICTLY FOLLOWED—all ALCO feedwater heaters are designed and built to comply with the requirements of the ASME Code.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Dunkirk, N.Y.

***In step with tomorrow*—Alco Aircoolers, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe**

Mail the coupon for complete details about ALCO feedwater heaters and your other power plant equipment needs, or call your nearest ALCO Sales Engineer at Beaumont, Chicago, Dunkirk, Houston, Kansas City, Los Angeles, New York or Tulsa.

ALCO PRODUCTS DIVISION P
American Locomotive Company
Schenectady, New York

Gentlemen:

Please send me information on the following items:

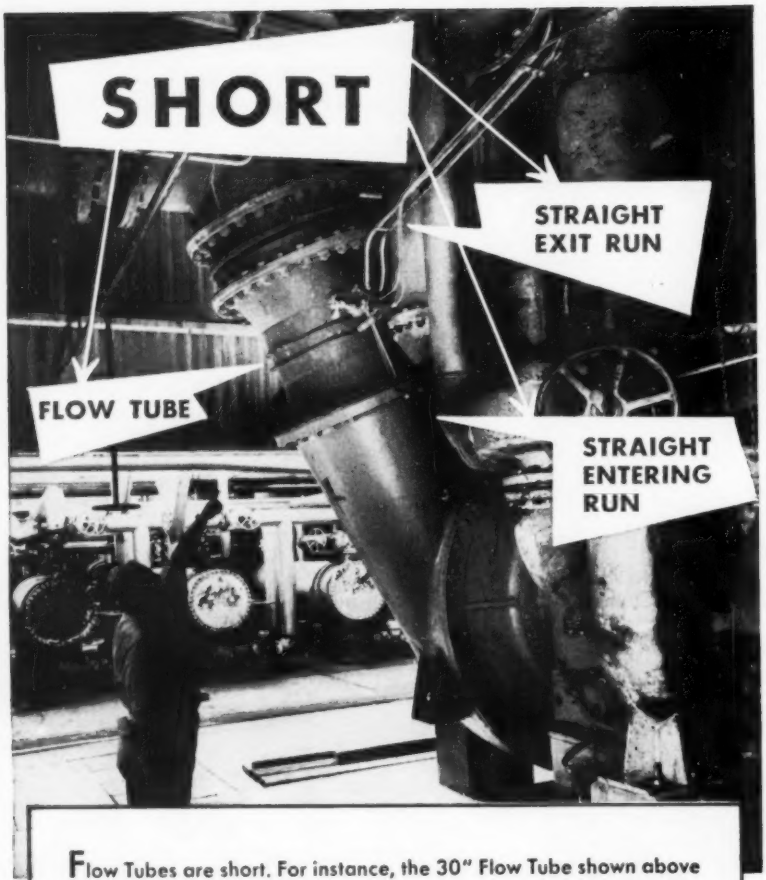
1__ 2__ 3__ 4__ 5__ 6__ 7__ 8__ 9__ 10__ 11__
12__ 13__ 14__

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____



Flow Tubes are short. For instance, the 30" Flow Tube shown above is only 30", face to face. And because they need only minimum straight runs entering and following, they can be installed at practically any accessible point where flow conditions are reasonably steady.

This important advantage means easy, convenient, economical installations.

Flow Tubes are manufactured exclusively by Foster Engineering Co. in all pipe sizes for measuring the flow of liquids and wet or dry gases. They can be furnished with or without suitable secondary indicating, recording or totalizing instruments, and, to insure maximum combined accuracy of primary element and receiver, each Flow Tube is furnished with an individual head capacity curve. For unusual piping arrangements, calibration curves for simulated conditions can be furnished.

For further information, ask for Bulletin FT-101; and for specific recommendations, please send us necessary flow data.

PRESSURE REGULATORS • RELIEF AND BACK PRESSURE VALVES • CUSHION CHECK VALVES • FAN ENGINE REGULATORS • PUMP GOVERNORS • TEMPERATURE REGULATORS • FLOAT AND LEVER BALANCED VALVES • NON-RETURN VALVES • VACUUM REGULATORS OR BREAKERS • STRAINERS • SIRENS • SAFETY VALVES • FLOW TUBES

FOSTER ENGINEERING COMPANY • UNION, N. J.

More TECHNICAL BRIEFS

Begins on page 152

an entirely different direction and installed an experimental steam generator of the once-through type built for 1,400 psi. Many years of dealing with regulating problems and in manufacturing the necessary equipment, the author says, enabled Sulzer to find an entirely new and foolproof way of controlling the forced circulation. It was, therefore, decided to continue the development of high-pressure steam generators along these lines, and soon afterwards another experimental unit of 22,000 lb per hr capacity was built. In 1931 orders were received for steam generators of 1,500 psi for a dyeworks and a district heating plant in Switzerland. These plants, combined with systematic research, proved to be milestones on the road to future developments. The author then discusses the advantages this design gives. *ASME Paper No. 52-A-121.*

Boiler Designs Developed For Controllability. *By P R Loughin, Babcock & Wilcox Co.*

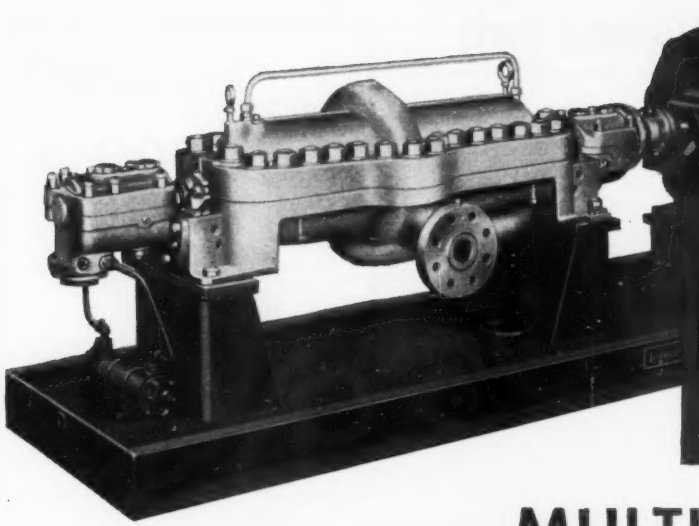
The expansion of electrical generating systems generally occurs during periods of rising fuel and labor costs. This has logically resulted in specifications and purchasing practices aimed at increased efficiencies with a minimum initial investment and minimum operating costs per unit of output. It has brought about a trend toward adding the maximum size of single-boiler single-turbine unit the system load will permit. This practice has already progressed to the stage where some systems can no longer base load the newer large units and take the swings on older less efficient units, and the large single-boiler single-turbine is required to take load swings.

A paper was presented to the AIEE in January 1949 by P S Dickey and P R Loughin titled, *Design of Boilers and Control for Fluctuating Loads.* This paper outlined some of the extreme fluctuating load conditions encountered in stationary and marine fields and described factors that govern the rate of response to load increase. Brief references were made to boiler design features that contributed to the overall result.

This paper will review the development of some of the features of modern boiler designs which facilitate control of these units under varying load conditions.

Water level control is one essential. It aims at (1) Complete separation of steam from water for all pressures ap-

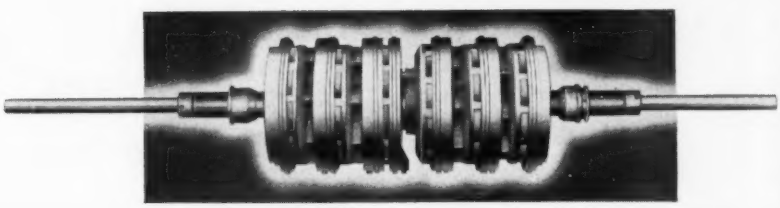
Directions for ordering papers on p 154



Ingersoll-Rand

CNTA

MULTI-STAGE PUMPS



extend the advantages of the

UNIT-TYPE ROTOR ASSEMBLY

HIGHER SUSTAINED EFFICIENCY

Greater simplicity of design, with precision-matched impellers and channel rings, permits unusually high efficiency which is sustained throughout years of operation.

GREATER DEPENDABILITY

Radial balance with multiple-volute design and axial balance with opposed impeller grouping, assure long trouble-free operation. The smooth-bore, symmetrical outer casing eliminates any possibility of distortion under high temperature operation.

REDUCED MAINTENANCE

Entire rotor assembly can be removed from the casing as a single, compact unit, without disturbing piping connections. There are no ring fits to align on replacement of the rotor assembly.

to your medium pressure applications

• With the completely re-designed line of CNTA multi-stage pumps, Ingersoll-Rand offers a new high in performance, efficiency, dependability and economy—for medium-pressure boiler feed, mine dewatering, marine, petro-chemical and general hydraulic services.

The advanced design Unit-Type rotor assembly, with impellers and channel rings mounted on a single, heavy-duty shaft and with a smooth-bore outer casing, is the same type as that used by Ingersoll-Rand in the high-pressure CHTA and HMTA lines. The result of this modern construction is a dependable, simpler and more rugged unit that requires minimum attention and maintenance.

CNTA pumps are multi-stage, horizontally split units, with single-suction impeller groups placed back-to-back to eliminate hydraulic thrust. They are available in 4, 6 and 8 stages for pressures from 100 to 800 psi, in capacities from 50 to 700 gpm.

Your I-R representative will be glad to give you the *complete story*.

Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.

844-10

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

TWO STAGE — DOUBLE ADJUSTMENT

Crusher is pictured without hopper and sprocket guards, but is delivered complete.

Two Stage CRUSHING IN ONE MACHINE!

The GUNDLACH "Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot.

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

T. J. GUNDLACH Machine Co., Belleville, Ill.

WRITE TODAY FOR CRUSHER BULLETIN P-3

More TECHNICAL BRIEFS

Begins on page 152

proaching the critical so as to attain: (a) High quality of steam for delivery to the superheater, turbine, (b) Steam-free water for the boiler circulating system to attain optimum circulation and minimum effect on water level stability with changes in rating and operating pressure. (2) High efficiency of separation so as to permit the boiler circulating system to provide the necessary energy. (3) Operating leeway with respect to water level control and boiler water conditions. (4) Economy of space to minimize the diameter and length of steam drum required.

Steam temperature control has followed the trend to require full design steam temperatures at partial loads. Not many years ago the simple gas by-pass was adequate to produce a modest range of control with acceptable operating characteristics. Improvements in control characteristics and extension of the control ranges were made economically possible by the development and use of spray attemperators or submerged surface attemperators. During this period the effectiveness of the steam temperature control devices was enhanced and improved by providing spaced burners and means of furnace wall cleaning that could be used very effectively by the operators in obtaining the desired result. An additional means of controlling steam and reheat temperatures is gas recirculation.

About four years ago some large central station units were designed to employ pressure firing. Pressure firing involves the use of a forced-draft fan (or fans) handling cold clean air capable of supplying the quantity of air required for combustion and overcoming the entire system resistance without the aid of an induced-draft fan. The principle was not new, but its application to large Central Station units was novel and it involved the development and the solution of many problems of design, materials, fabrication, erection, and operation. One objective was to obtain higher overall station efficiency by elimination of air infiltration, and by having fans pumping cold, dense air instead of hot gas. Another objective was to reduce maintenance and improve availability on coal-fired units by minimizing or eliminating induced-draft fan wear. Another objective that has not yet been fully attained on large coal-fired units was to reduce initial investment by elimination of induced-draft fans, motors, dampers, and controls. *AIEE Paper No. 53-140.*

Directions for ordering papers on p 154

Jefferson 300 Lb. UNIONS

These 4 Features contribute to long, care-free, economical service:

1. Made of Air Furnace, Malleable Iron (55,000 p.s.i. tensile strength)
2. Air Tested Before Shipment
3. Providing a Ball Joint of True Spherical Contour
4. Offering a Performance-Proved Recessed Brass Seat of Exclusive Design

All Jefferson "300 LB." Unions are plainly so marked . . . a "cast-in-metal" hall-mark of high quality . . . for your protection and assurance of long, dependable service.

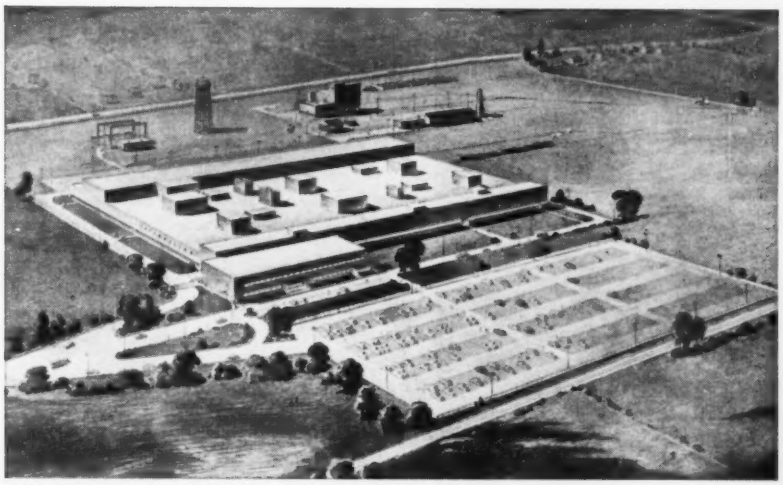
To take advantage of all these features is to get the highest return on your pipe union dollar and lowest cost per year of service.

Jefferson offers OWG 2000# to 2" and 1000# up to 4". The complete line includes AAR male and female unions, Enduro 300#, Excel 250# and Master 150# unions. All types are also available with all-iron sets. Underwriters approved.

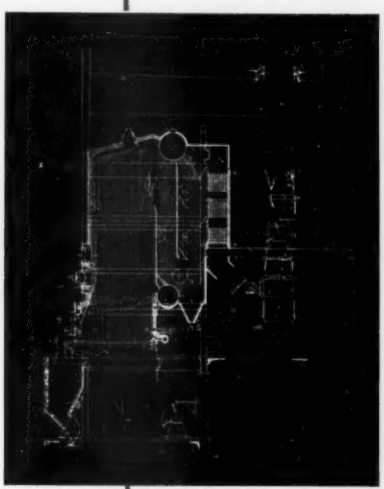
Get in touch with your nearest distributor or with us direct for your requirements.

JEFFERSON UNION CO.
605 W. 26th St., New York 1, N. Y.
63 Gooding St., Lockport, N. Y.
39 Fletcher Ave., Lexington 73, Mass.

TWO WICKES STEAM GENERATORS will help heat the CATERPILLAR TRACTOR CO.'s new plant at York, Pa.



CONTRACTORS: Consolidated Engineering Company Inc., Baltimore, Md.
CONSULTING ENGINEERS: Whitman, Requardt & Associates, Baltimore, Md.



The Caterpillar Tractor Co., one of the world's largest manufacturers of earth moving equipment, will shortly open their new York, Pa. plant where several hundred men will turn out track assemblies for world famous Caterpillar D6, D7 and D8 Tractors. In this modern manufacturing facility, Caterpillar has installed two 80,000 lb. WICKES steam generators to obtain efficient, economical heat throughout the 360,000 sq. ft. structure. These Type R 2-drum WICKES boilers have a design pressure of 200 psi. and are equipped with economizers and spreader stokers. WICKES can fill your requirements for steam generators up to 250,000 lbs. per hour and 1000 psi. — all types of multiple drum boilers, adaptable to any standard method of firing: oil, gas, underfeed or spreader stoker. Consult your nearest WICKES representative or write us today for descriptive literature.

145

WICKES

THE WICKES BOILER CO., SAGINAW, MICHIGAN • DIVISION OF THE WICKES CORPORATION

RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Greensboro, N.C. Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • Springfield, Ill. • Tampa Tulsa • Washington, D. C.

Steam Production News

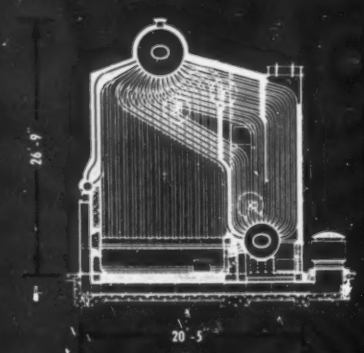
MODERNIZATION AT WALTER REED GENERAL HOSPITAL FEATURES TYPE K-

BIGELOW

Two Type K Boilers By Bigelow provide up-to-date steam production in the recently modernized heating plant of the Army Medical Center, Walter Reed General Hospital, Washington, D. C.

Each boiler has a capacity of 75,000 lbs. of steam per hour — continuous and 82,500 lbs. of steam per hour for 4 hour peaks. Both boilers are oil-fired with four burners per boiler. Combustion control equipment is mounted on a central panel serving both boilers.

The boilers are built and installed in accordance with specifications of The Corps of Engineers U. S. Army. The mechanical contractor was Harry E. Nau & Co., Inc., Washington, D. C.



BOILERS BY BIGELOW

THE BIGELOW COMPANY • NEW HAVEN 3, CONN.
Established 1833

BIGELOW REPRESENTATIVES: Boston • New York • Chicago Philadelphia • Syracuse • Detroit • Atlanta • Milwaukee New Orleans • Petersburg, Va. • Washington, D. C. • San Francisco Los Angeles • Seattle • Knoxville

More TECHNICAL BRIEFS

Begins on page 152

Effect of Swinging Loads on Steam Plant Economy. *By W D Wilder and H J Thielke, U. S. Dept of Interior.*

The advent of automatic frequency and tie-line control brought new problems to generating station personnel. Plants accustomed to holding block loads were, of necessity, forced to carry swinging loads. While data on station economy were readily available for block or steady loads, no information had been collected as to the effect of swinging loads. In some cases installation of control equipment was postponed due to fear of excessive operating and maintenance costs.

In an attempt to determine the magnitude of additional costs due to swinging loads, a series of tests were made at the Huntley Station, Buffalo, N.Y., where generating units of different pressure and temperature were available for comparative purposes. This paper is presented as a preliminary progress report. It is expected that more comprehensive tests will be conducted at a later date.

In order to obtain results comparable to those encountered in daily operation, the tests were run under normal operating conditions. Measurements of fuel input and energy output were taken on standard coal scales and watt-hour meters, respectively, with no special measuring equipment being added for the occasion. Coal samples were taken throughout the test in order that heat values could be determined.

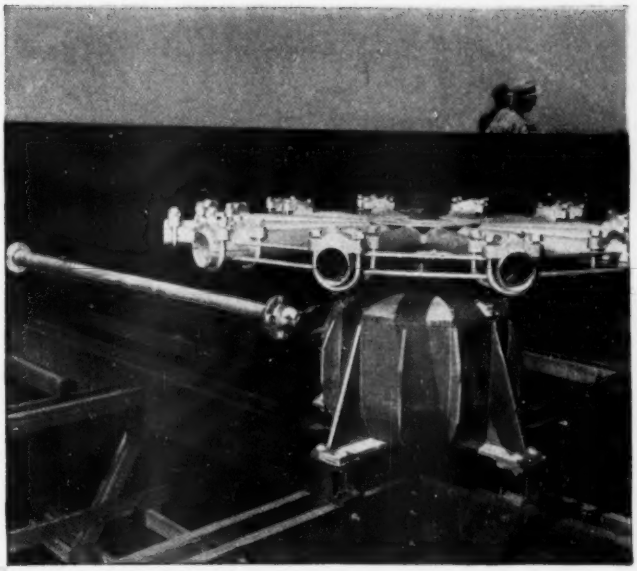
For any given load level, two tests were run, one under steady load and a second under swinging load conditions. Swinging loads were simulated by switchboard operator who manually varied generator output 10 megawatts above or below the preceding steady load level. Generator output was varied at random to duplicate actual automatic control conditions as nearly as possible. A temporary governor control equipment was installed for the test. Test procedure was as follows:

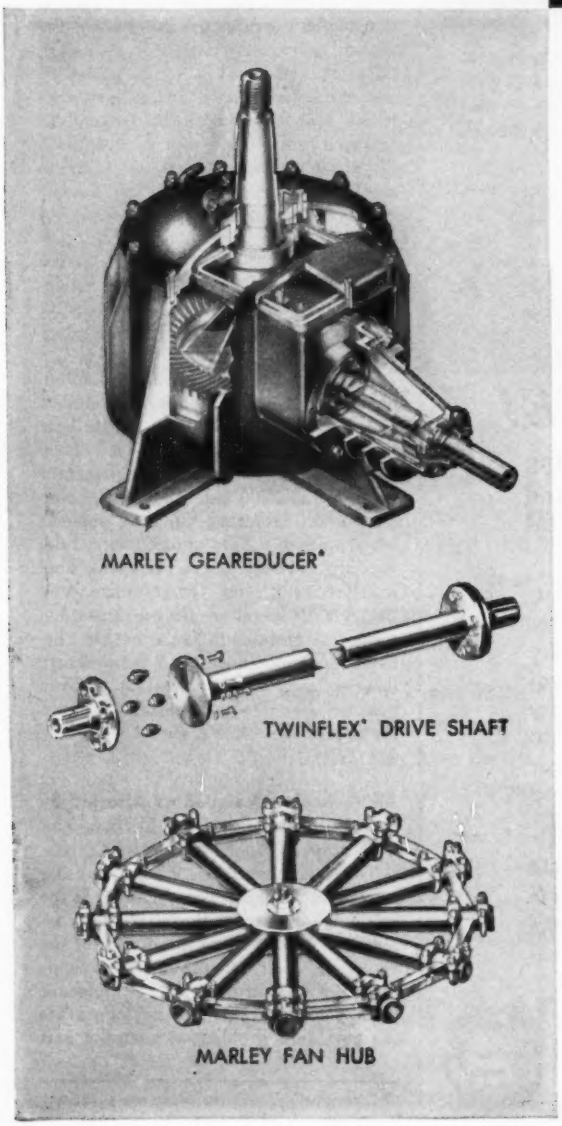
1. Roughly one hour levelling off period at selected load level. 2. Reading of coal scales and watt-hour meters. 3. 4-hour test run at steady load. 4. Reading of coal scales and watt-hour meters. 5. 4-hour test run at swinging load. 6. Final reading of coal scales and watt-hour meters.

From the test results it appears that only minor increases in steam electric production costs are due to carrying swinging loads. These increases are of such small magnitude that they might

Directions for ordering papers on p 154

MARLEY Mechanical Equipment is POWERED for PERFORMANCE





Driving the large fans of modern cooling towers is a rugged job . . . one that demands power transmission equipment designed with an extra measure of sturdiness. With its added strength it must also be precision built for long, smooth service. That's why Marley designs and manufactures every element of the mechanical equipment for Marley cooling towers. The result is specialized equipment for a specific service.

MARLEY GEAREDUCER*

An exclusive Marley design utilizing hardened alloy steel gears, tapered roller bearings and heavy, carefully machined shafts—all in an extra strong, well sealed, cast iron case. Lubrication to every point is constant and flow is maintained whether operation is forward or reverse.

MARLEY TWINFLEX* DRIVE SHAFT

This accurately balanced assembly is constructed of heavy steel tubing zinc-coated and sealed against internal corrosion by welded flanges. It transmits power to the cast steel yoke through pre-moulded neoprene inserts bonded to cadmium plated steel cores. They have excess load capacity that easily absorbs starting shock and transmits power smoothly.

MARLEY FAN HUB

This hub for largest fans is of all-steel construction. Hub spokes are seamless steel tube; center hub and clamps are steel castings. It is precision welded throughout for great strength. After fabrication, the hub is hot dip galvanized. The design provides quick adjustment for fan pitch and uses a retention pin for added safety.

Any Cooling Tower May Be Modernized with Marley Mechanical Equipment

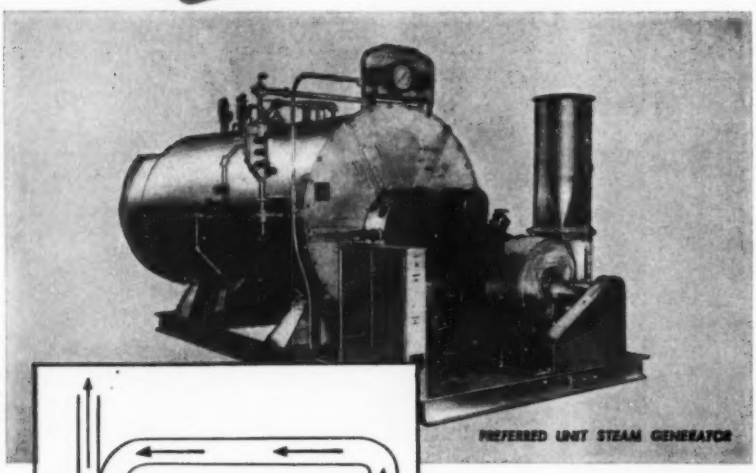
*Registered trade mark

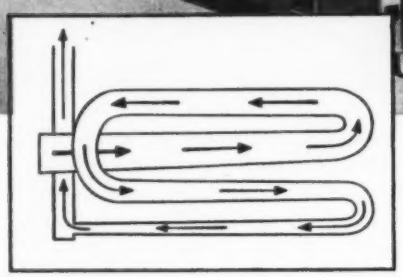
The Marley Company

Kansas City, Missouri

MARLEY

there *IS* a difference*





*Four Pass Gas Travel — another 25-year built-in Preferred "Quality Feature" that means definite efficiencies and lowered costs.

in gas travel design that means MORE EFFICIENCY and CAPACITY with LESS MAINTENANCE!

Preferred's Unit Steam Generator, with FOUR-PASS GAS TRAVEL, insures a minimum of 80% efficiency and rated capacities that actually means — *MORE STEAM AT LESS COST.*

Everyone knows **heat absorption per square foot of heating surface increases as the velocity of the heated gases increases. To insure relatively constant high velocity throughout, Preferred *reduces gas passage area* to compensate for decreased gas volume. High gas velocity through the greater length results in high resistance to gas flow assuring even distribution of the gases, cleaner heat transfer surfaces with less tube cleaning, and lowered stack temperatures *year after year.***

Hundreds of plant engineers and consulting engineers readily admit that you can buy cheaper unit steam generators but the general consensus of opinion is—*you can't buy anything better than a Preferred!*

For all the facts, write today for your free copy of Bulletin 2000 . . . see for yourself just how Preferred is different and why it's a better buy.

PREFERRED UTILITIES MFG. CORP.

297 **1860 BROADWAY · NEW YORK 23, N.Y.**

More TECHNICAL BRIEFS

Begins on page 152

well be caused by inherent inaccuracies of the measuring devices used. *AIEE Paper No. 53-148.*

Fuels and Firing

Experimental Studies of Boiler Metal Temperatures. *By C Jacklin, National Aluminate Corp.*

The development of reliable methods of measuring the thickness of deposits in steam boiler tubes in place has enabled boiler operators to obtain factual information regarding the location and thickness of deposits in their boilers without removing tube sections. Analyses of carefully selected samples can generally be relied upon to show the chemical composition of these deposits.

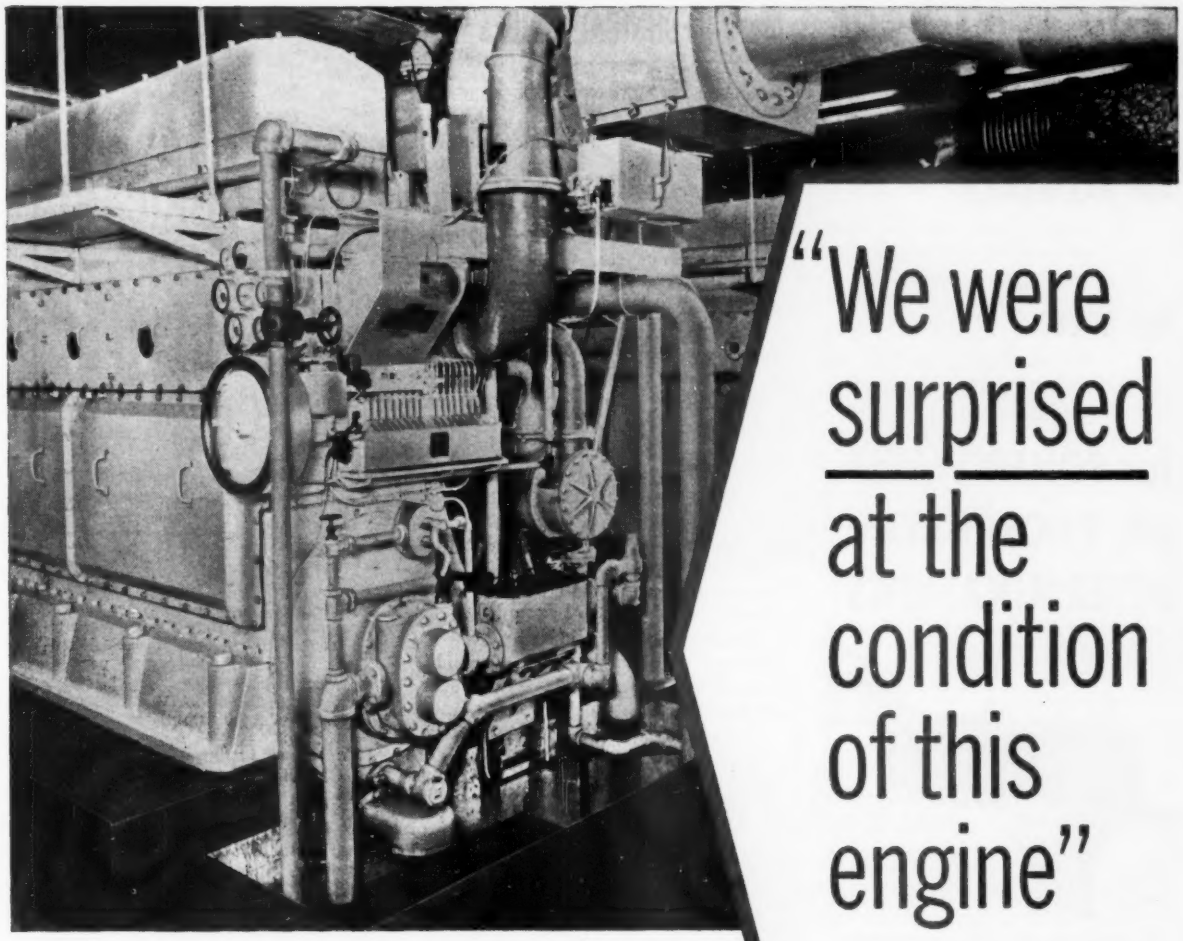
After an operator has determined the amount and kind of deposit in his boiler, he must decide what to do about it. Can the boiler be returned to service as it is? Can the deposit be reduced or removed while the boiler is in service by making changes in the water treatment program? Or must the deposits be removed by chemical or mechanical cleaning before the boiler can be operated safely and efficiently. This paper attempts to pin down some of the answers on the effect of metal deposits on heat transfer and tube metal temperatures.

The author employed an induction-heated experimental boiler for studies of tube metal temperatures under heat transfer rates from 140,000 to 300,000 Btu per sq ft per hr and for pressures from 250 to 2500 psi. Clean tube conditions and different kinds of deposits were studied. The approximate relationship between metal thickness, heat transfer rate, and temperature drop through the metal are shown in graphic form. Approximate relationship between scale thickness and temperature increase in the tube metal at a given heat transfer rate and pressure is shown for four scales. *ASME Paper No. 52-A-30.*

Air Preheater Designed as Affected by Fuel Characteristics. *By H Karlsson and W E Hammond, Air Preheater Corp.*

The fuel characteristic that appears to control plugging and corrosion is the sulphur content. While other fuel constituents contribute to the degree of the problem, their effectiveness depends upon the sulphur content. The presence of carbon in the fuel gas may aggravate the corrosion problem so that the best

Directions for ordering papers on p 154



"We were surprised at the condition of this engine"

... says G. V. Yarger,
Supt. Municipal Utilities
Waverly, Iowa

"When we finally opened up our Worthington, it was in the *best* condition I've ever seen a diesel engine that had operated such long hours and under such heavy loads as this unit. It had a total of 48,926 hours on it – 8,987 hours of tough operation since the last overhaul.

Mr. Yarger continues, "We've been using Sinclair RUBILENE® Heavy in the crankcase and RUBILENE H.D. 30 in the cylinder lubricator. These RUBILENES have kept the crankcase and upper portions of the cylinders exceptionally clean and bright, with no sign of carbon or deposits."

That's a typical report on the exceptional qualities of the Sinclair RUBILENES . . . evidence that they could improve the efficiency of *your* diesels, too. Why not switch now? Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL OILS

save wear and replacements

You can't beat TAYLOR COMPARATORS

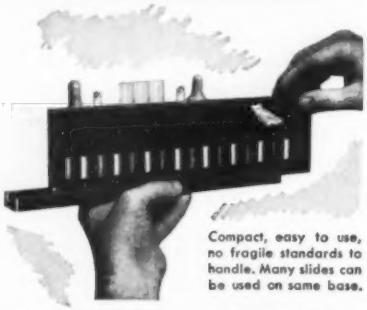
for ACCURACY

Liquid color standards are unconditionally guaranteed against fading.

for SPEED

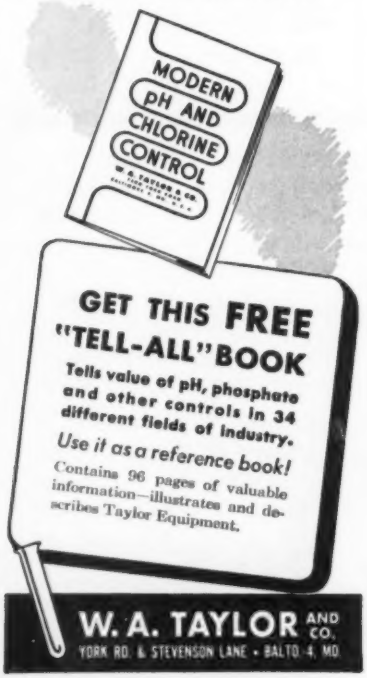
Simple 3 step method requires less than one minute to make reading

for BOILER WATER, pH, PHOSPHATE DETERMINATIONS



Compact, easy to use, no fragile standards to handle. Many slides can be used on same base.

SEE YOUR DEALER...OR WRITE DIRECT FOR COMPLETE INFORMATION ABOUT THESE WIDELY USED COMPARATORS


MODERN
pH AND
CHLORINE
CONTROL
GET THIS FREE
"TELL-ALL" BOOK
Tells value of pH, phosphate and other controls in 34 different fields of industry.
Use it as a reference book!
Contains 96 pages of valuable information—illustrates and describes Taylor Equipment.

W. A. TAYLOR AND CO.
YORK RD. & STEVENSON LANE • BALTO. 4, MD.

More TECHNICAL BRIEFS

Begins on page 152

combustion conditions must be carefully maintained.

In selecting air heaters for new installations, it is not possible to predict with any certainty the type of fuel that will be available during the life of the application, consequently, the air heater design must provide controls that will maintain the cold end temperatures within safe limits.

The use of Cor-Ten or Mayari-R for the low temperature surface and the use of cold end gaskets is recommended.

Application of effective soot blowers using superheated steam or dry compressed air permits control of deposit formation. In the event that circumstances result in serious deposit formation, provision for water washing of the heaters will provide an effective remedy. Often the very nature of these deposits aggravate the corrosion tendencies.

Consistent attention must be given to cold end temperature under all conditions of operation and in this respect automatic controls should be considered.

The various means for obtaining cold end temperature pro'ection are well known: (1) Cold air by-pass, (2) Hot air recirculation, (3) Steam air heaters, (4) Combiflow—parallel—counterflow, (5) Reduction of surface. The authors briefly discuss the good and bad points of each.

The final selection of the most suitable control for a given installation must be based upon economic evaluation of the particular case. Since the factors controlling these evaluations are different for each application, it is not possible to generalize.

The efficacy of these various control methods can only be realized if they are consistently used. In this respect it would probably be desirable in considering new installations to weigh carefully the value of automatic controls. *ASME Paper No. 52-A-125.*

Laboratory Investigation of Superheater Tubing in Combustion Atmospheres at 1350 F. *By C J Slunder, A M Hall, and J H Jackson, Battelle Memorial Institute.*

The ASME Research Committee on High-Temperature Steam Generation has been active in studying the problems arising in the design of equipment to produce steam at high temperatures. One phase of this study sponsored by the Committee at Battelle Memorial Institute was to evaluate commercially available alloys for their resistance to products of combustion at a tempera-

Directions for ordering papers on p 154

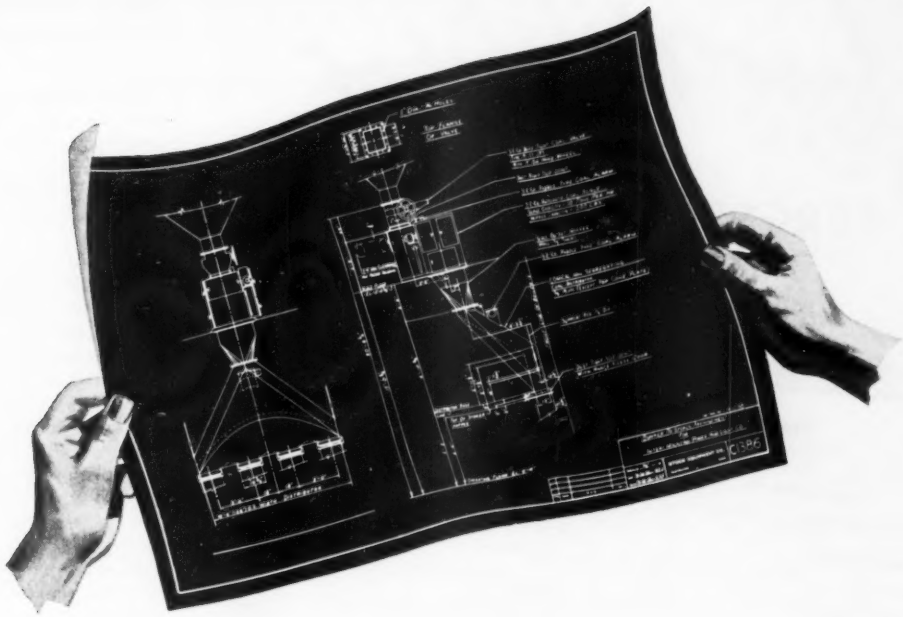
"THIS LUBRICANT EXTENDED BEARING LIFE 50%"

—says REPUBLIC AVIATION CORP.
Makers of the famous F-84E THUNDERJET

"Under actual tests, LUBRIPLATE extended bearing life fifty per cent or better as compared to other lubricants. It was also found that, during test, LUBRIPLATE increased efficiency of machines twenty per cent by reducing friction loss. Republic has been using LUBRIPLATE successfully for the past eight years."

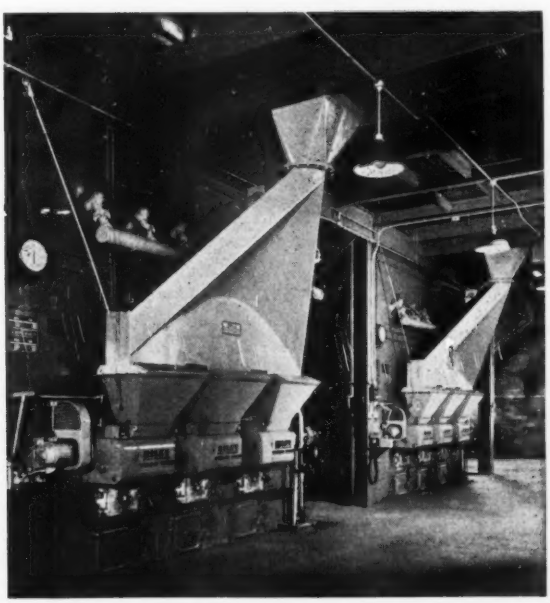
For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.



The Power Engineer With Blue Print

S-E-Co. CONICAL Distributors with dust-tight slip-joint connections to stoker hoppers at the J. Greenebaum Tanning Company, Milwaukee, Wisconsin. S-E-Co. Automatic Coal Scales and Under-Bunker Drag Conveyor are located on floor above.



sees how well-designed Bunker to Stoker Equipment results in good coal flow. By careful planning, coal segregation and coal stoppage are eliminated. Thus, the plant operator enjoys efficient and reliable stoker operation.

You can depend on Bunker to Stoker Installations as designed and furnished by Stock Equipment Company to give you the best in originality combined with proven design. These installations feature the S-E-Co. Coal Valve and the S-E-Co. CONICAL Non-Segregating Coal Distributor which is the only stationary means of delivering coal to a stoker without segregation. They also include the S-E-Co. Automatic Coal Scale to give true weights of coal burned. These unexcelled products are applied with a know-how that has been gained through years of experience in pioneering and specializing in this field.

Call on Stock Equipment Company to help you with your layout of new Bunker to Stoker or Pulverizer Installations or in the renovation of your existing facilities.

STOCK EQUIPMENT COMPANY

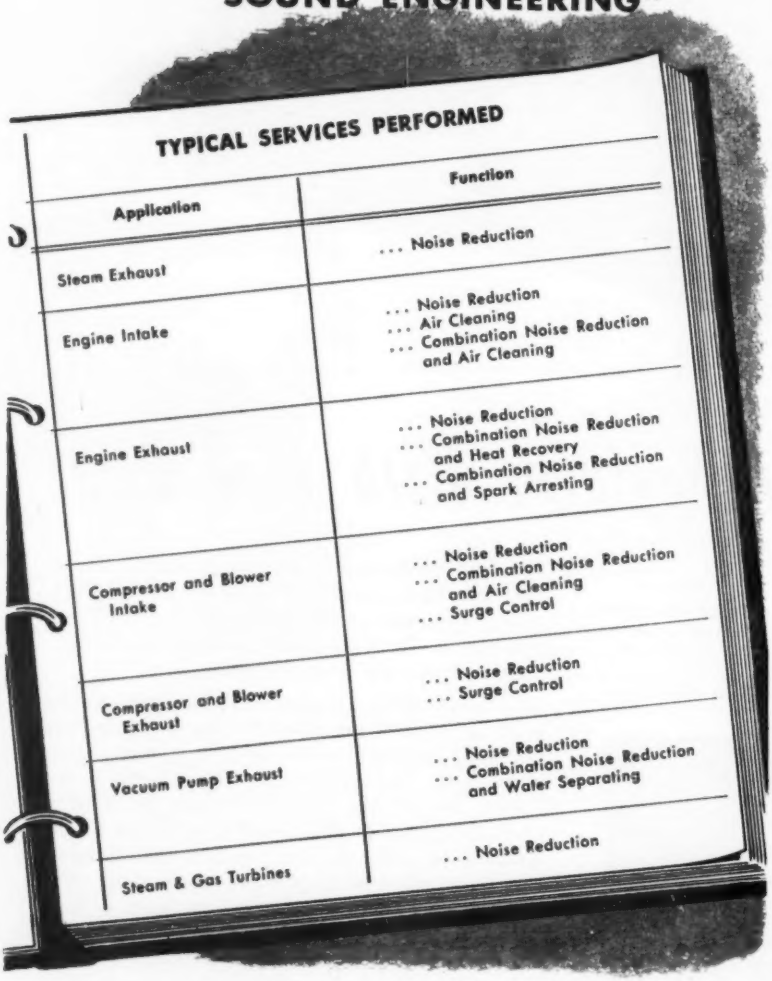
745P HANNA BUILDING

CLEVELAND, OHIO

Versatility of

BURGESS-MANNING COMPANY

"SOUND ENGINEERING"



Our extensive line of standard and special noise attenuating SNUBBERS and silencers permits us to recommend the most suitable units for your particular application.

Consult Burgess-Manning Engineers, today.

749-J East Park Avenue, LIBERTYVILLE, ILLINOIS

Chicago **Dallas**

More TECHNICAL BRIEFS

Begins on page 152

ture of 1350 F.

The first part of the program dealing with the testing of alloys under actual field conditions has been completed, and was described in a paper presented to the ASME last year by Blank, Hall, and Jackson. In these field tests, bars of selected alloys were suspended in various steam-generating units so that they would attain an average temperature of about 1350 F, while exposed to the hot products of combustion. The units chosen for these tests were representative of coal, oil and gas firing, and thus provided a variety of combustion atmospheres. The corrosion results reported in this paper showed that these atmospheres varied widely in their corrosive effects. It appeared that the degree of corrosion was related to the sulfur, vanadium, and alkali-metal contents of the fuels burned. Under mildly corrosive conditions most of the alloys tested were practically unattacked, and from a corrosion-resistance standpoint, should be suitable for use in superheaters at 1350 F. Under very corrosive conditions, however, all the alloys were corroded, with AISI 309S, 310, and 314 the most resistant of the alloys tested.

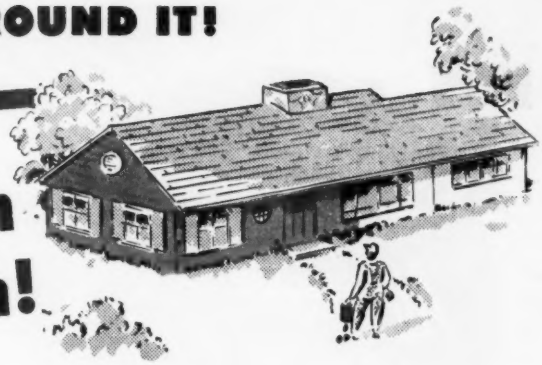
The next phase of the program was to evaluate the alloys in laboratory tests designed to stimulate some of the corrosive conditions existing in actual service. It was expected that the variables could be controlled more closely in these tests than in field tests, and that the effects of specific variables would be more readily observed.

Accordingly a group of commercially available alloys was tested for resistance to synthetic combustion atmospheres at 1350 F in controlled laboratory experiments to determine their suitability for use as superheater tubing materials. Variables in the corrosive environment included two concentration levels of sulfur dioxide, carbon monoxide, and alkali-metal salts. Evaluation on the basis of resistance to both scaling and subsurface corrosion showed that alloys of the 25-12 and 25-20 types were superior. AISI 304 also behaved very well in these tests. These results verify the conclusions of the field tests in installations burning low-sulfur natural gas or coal. The conditions obtained in burning high-sulfur, high-vanadium oil were not included in the laboratory tests. *ASME Paper No. 52-A-36.*

Resistance of Cast Alloys to Corrosion in Flue-Gas Atmospheres. *By J H Jackson, C J Slunder, O H Harder, Battelle*

Directions for ordering papers on p 154

NO GETTING AROUND IT!



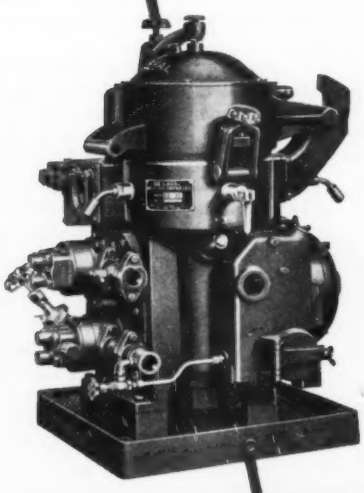
Half-Way Protection Is Not Good Enough!

De Laval Oil Purifiers continuously remove and discharge water while removing the dirt as well. And water is the real trouble maker as often as not. In turbine lubricating systems, for instance, condensate water in the oil leads to the formation of sludge, and sludge, of course, is well recognized as the source of trouble in turbine lubrication systems.

Diesel oils, too, should be kept dry if the formation of emulsions is to be avoided. Purification by centrifugal force is of more than ordinary importance with the heavier types of diesel lubricating oil.

Centrifugal force applied in the De Laval bowl gives equally positive protection against dirt . . . keeps the oil clean and in "like-new" condition.

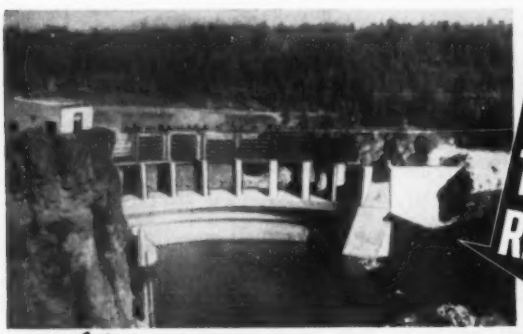
In short, De Laval Oil Purifiers afford turbines and diesel engines ***full protection*** against the principal causes of lubrication failure, by removing the impurities that contaminate oil in service.



THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL for more dependable power production

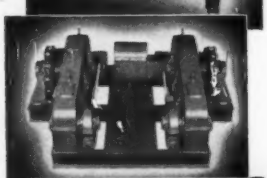
BOILER TUBE CO. OF AMERICA
McKEES ROCKS, PA.
(Pittsburgh District)
PITTSBURGH • CHICAGO • FRED S. RENAULD & CO., LOS ANGELES

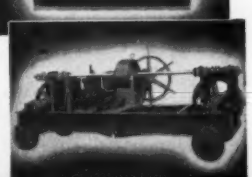


DESIGNED AND BUILT TO MEET ALL REQUIREMENTS

Murray GATES & GATE HOISTS! for any Size Power Dam

Cabinet Gorge Dam On Clark Fork River Idaho





MURRAY GATE HOISTS are designed and built in a wide range of capacities from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist.

In over 50 years of designing and building gate hoists, we have developed designs for many gate hoist problems. We may have designs and patterns to fit your special requirements. In planning gates or gate hoists, we suggest you write us before your over-all plans are complete . . . it may save time and money. We also build gate hoists to fit your plans and specifications.

Write for complete information and Engineering Department recommendations.

MURCO

D. J. MURRAY MANUFACTURING CO. WAUSAU, WIS.

More TECHNICAL BRIEFS

Begins on page 152

Memorial Institute and J T Gow, Electric Steel Foundry Co.

The extensive use of iron-chromium-nickel alloy castings in various applications has been dictated by their desirable mechanical and chemical properties at elevated temperatures. Structural members for use in furnaces, boilers, and assemblies for some chemical processes must retain their strength at the high operating temperatures involved. It is estimated, for example, that the cast alloy hangers used in boiler furnaces may reach temperatures of about 1900 F or more, and alloy manufacturers have had to develop alloys strong enough to withstand considerable stressing at these temperatures.

It must be recognized that, while high-temperature strength properties of alloys should be given first consideration in the selection of an alloy, the maintenance of these properties in severe corrosive environments is equally important. Oxidation is an obvious and common form of metal deterioration.

Corrosion of iron - chromium - nickel castings by sulfur-bearing gases at 1800-2000 F has been investigated for the Alloy Casting Institute in a comprehensive series of tests. The sulfur was varied from 0 to 500 gr per 100 cu ft. in both reducing and oxidizing flue gases. The effects of cyclic temperature fluctuations and alternately oxidizing and reducing atmospheres were also studied. Both metal loss and subsurface attack were considered in evaluating the alloys.

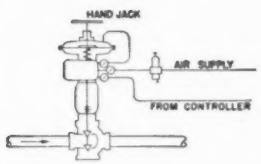
A wide range of composition of the ternary system Fe-Cr-Ni was studied with the chromium varying from 11 to 36% and the nickel from 0 to 70%. Although the behavior of the present commercially important alloys deviated in specific instances, it was shown that, in general, the HE (28% Cr-9% Ni), HK (26% Cr-20% Ni), and the HH (26% Cr-12% Ni) type had the best resistance under a variety of test conditions. The HW (12% Cr-60% Ni) alloy was generally better than the HT (15% Cr-35% Ni) alloy and both performed well until the sulfur content of the gas was raised to 100 grains per 100 cubic feet. The HX (17% Cr-66% Ni) and HU (19% Cr-39% Ni) alloys were generally better than the HW and HT types. However, they too were inferior to the HE, HK, and HH types when sulfur contents were 100 grains per cubic foot or higher. The HF (20% Cr-10% Ni) alloy originally designed for temperatures below 1600 F performed reasonably well in the

Directions for ordering papers on p 154

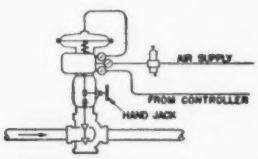
FISHER® Versatile Usage

TYPICAL EXAMPLES OF FISHER DIAPHRAGM MOTOR VALVE WIDE RANGE ADAPTABILITY

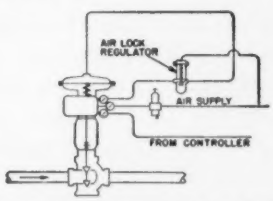
Built for your specific requirements, Fisher Diaphragm Motor Valves are manufactured to handle pressure conditions up to 10,000 pounds, for high pressure drops and are available in metals for highly corrosive service and alloys for high temperature work.



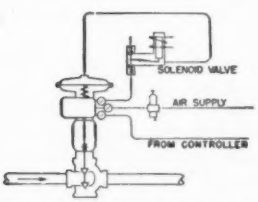
DMV with Hand Jack Operator. Allows for manual operation against spring action. Limits travel of valve. Example — Maximum opening in spring opened valve. Minimum closing in spring closed valve.



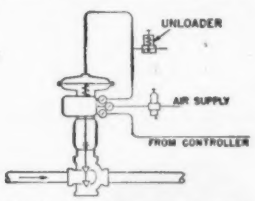
DMV with Continuously Connected Handwheel. Operator can open or close valve against controller action. Can operate valve manually if operating medium fails. Can set maximum opening or minimum closing of inner valve.



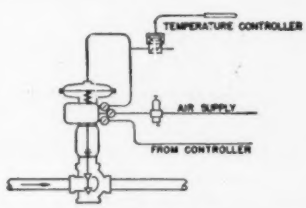
DMV with Air Lock. Should operating air supply fail, air lock regulator closes, locking pressure on diaphragm — valve remains at last position until operating air supply is re-established.



DMV with Remotely Actuated Electric Solenoid Trip Out. Valve may be fully opened or closed by unloading operating pressure from diaphragm by solenoid operation. Solenoid is actuated from manual switch or an electric tie-in circuit.



DMV with Air Cut-Out Feature. Valve member becomes inoperate, subject to manual handling to re-establish operation. When controller removes air from diaphragm, UNLOADER opens. Valve remains in this position — UNLOADER orifice is too large to allow air pressure to be re-established.



DMV — with Auxiliary Controller Over-ride. An auxiliary controller, such as temperature, placed in operating air line to diaphragm — can over-ride action of main control function by unloading diaphragm and taking over functional operation of DMV.

FISHER GOVERNOR COMPANY • MARSHALLTOWN, IOWA

Your Management wants to know about...

The practical approach to dust abatement

PLANT ENGINEERS, working with Buell engineers, have proven again and again that their know-how coupled with Buell's long experience in Dust Collection can solve your Fly Ash problems more economically, more efficiently.

What's more, Buell Dust Collection Systems offer all American industry these further advantages: smoother plant-community relations, improved product quality and better employee morale.

Buell's knowledge and experience in the highly specialized science of Dust Collection are yours. To learn more about Buell's **3 basic systems** of Dust Collection and how they can help you, send for the new, informative booklet titled, "The Collection and Recovery of Industrial Dusts." Buell Engineering Company, Dept. 50-D, 70 Pine Street, New York 5, New York.

Van Tongeren Cyclone | 'SF' Electric Precipitator | Precipitator-Cyclone Combination | Type 'LR' Collector | Dust Hopper Valves

ELECTRIC CYCLONIC ® buell

ENGINEERED EFFICIENCY IN DUST COLLECTION

More TECHNICAL BRIEFS

Begins on page 152

tests, and at 1800 F in reducing atmosphere containing at least 100 grains of sulfur per 100 cubic feet, the alloy was slightly superior to the HW and HT types.

In general, corrosion in the higher sulfur-bearing atmospheres was much less severe when the flue gas was oxidizing than when reducing. *ASME Paper No. 52-A-37.*

Tubular Air Heater Problems. *By E F Rothemich and G Parmakian, Riley Stoker Corp.*

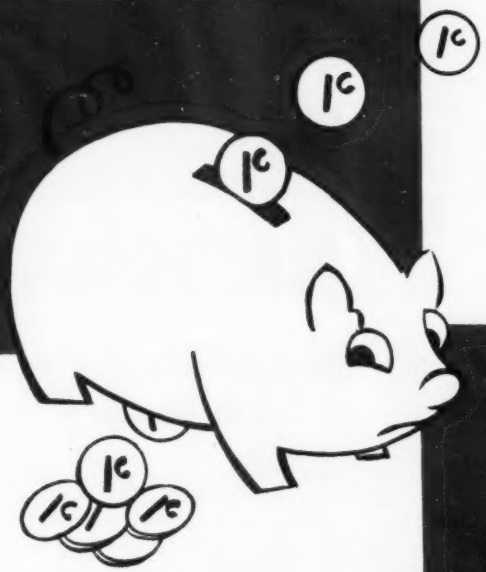
The paper discusses the occurrence of air heater deposits, their effect on performance, maintenance and design. Actual operating experiences and a survey of a large number of installed tubular air heaters are given to show the extent of the air heater problems being encountered by steam generating units fired with pulverized coal, stoker, natural gas, as well as those fired with oil. Suggestions are offered as to methods for minimizing these difficulties by design and operation.

An increase in the number of reports of plugging and corrosion of air heater tubes prompted an investigation of the problems being experienced with tubular air heaters. High sulphur content in residual fuel oils as a result of changes in refinery methods and in source of crude oil seems the main cause for the increase in air heater difficulties. Introduction of outdoor installations with low ambient air temperatures has also imposed severe operating conditions which have resulted in increased plugging and corrosion.

The chemistry of the formation of deposits in the cold end of heaters when burning fuels containing sulphur has been studied and discussed by various investigators. Stated very simply, sulphur dioxide formed in normal combustion of sulphur oxidizes to sulphur trioxide at the proper temperature for the change, in the presence of a catalyst such as iron oxide which is present on boiler and superheater tubes. Sulphur trioxide in the products of combustion elevates the dew point of the gases. Water vapor condenses and forms an acid with the sulphur trioxide and the corrosion of the tube results in iron sulphate. This deposit accelerates the corrosion process by further elevating the dew point. Corrosion and plugging seldom occur during the first year or so of operation and it often takes 5 to 6 years before corrosion of tubes progresses far enough to require replacements.

Directions for ordering papers on p 154

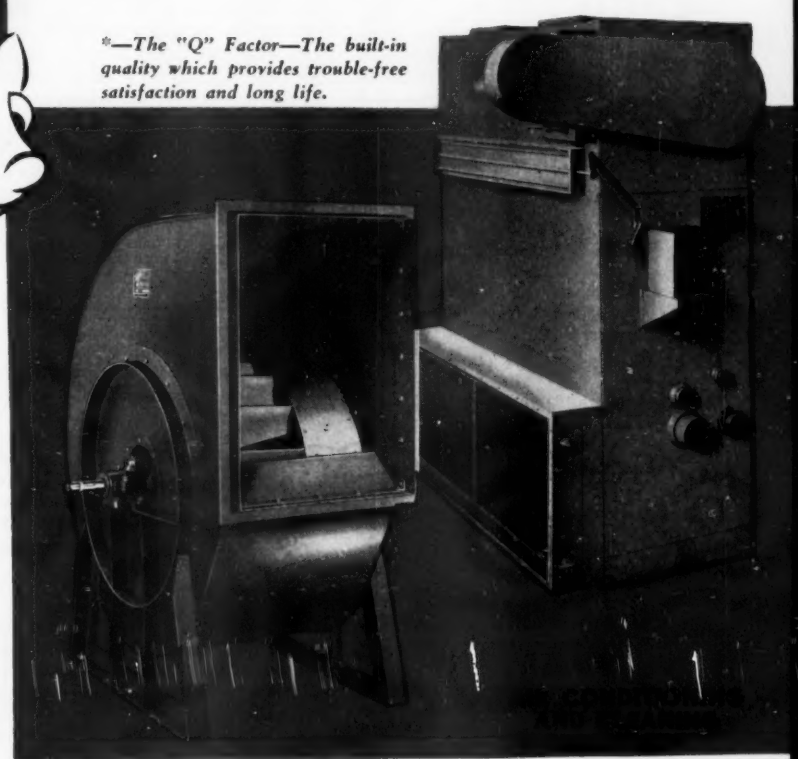
Pennies saved are not always pennies earned



TAKE the case of the man who saved a few dollars on air handling equipment, which he expected to use for many years. Installation costs turned out to be high and maintenance expense excessive—more than he saved on original purchase price. Of course, not every low bidder has an inferior product; but you can be sure of one thing: if a high quality product is to meet all low bids, the quality just can't stay high!

We at "Buffalo", with seventy-five years of top quality manufacturing behind us, call your attention to the "Q" Factor.* Without it we could not have maintained the performance records chalked up in many of America's outstanding industrial plants. We have no intention of abandoning the practice of building the best possible product and pricing it afterwards.

*—*The "Q" Factor—The built-in quality which provides trouble-free satisfaction and long life.*



VENTILATING FANS

Complete lines, the Jubilee Breezo, an efficient disk fan—the "LL", a non-overloading centrifugal, the Axial Flow, and many others for all services including forced and induced draft fans.

"Buffalo" Engineering Sales Representatives in all principal cities are anxious to work with you. Call on them for advice without obligation.

Full lines of industrial air cleaning equipment for gases and fumes, as well as air washers and cabinets for air conditioning.

DIAMOND JUBILEE 75TH ANNIVERSARY

"Buffalo" FIRST FOR FANS

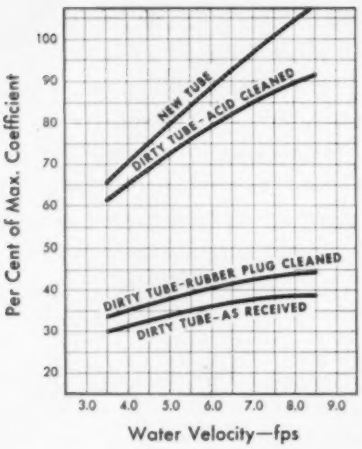
BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING | PRESSURE BLOWING | AIR CLEANING | COOLING | AIR TEMPERING | HEATING | INDUCED DRAFT | FORCED DRAFT | EXHAUSTING



Best way to
RESTORE
condenser tube
EFFICIENCY

90% of surface condensers do not perform as well as they should. One major cause is fouled tubes. And, only too often, when such tubes are rubber-plug cleaned, the results prove far from satisfactory.

In a recently reported test, it was shown that shooting rubber plugs through a fouled tube didn't fill the bill in successfully removing the type of scale encountered. See chart. But when the same tube was acid-cleaned, the heat transfer obtained approximated that of a new and clean tube.

Removing lime scale with that effective acid-descalant, Oakite Compound No. 32, more than repays for itself by the savings it makes in reduced turbine-steam consumption and lower fuel costs. It minimizes tube failure caused by partially obstructed tubes and eliminates the cost both of replacing tubes and of idle condenser capacity.

After you have removed lime scale with Oakite Compound No. 32, you can prevent further build-up by treating condenser circulating water with Oakite Airefiner No. 52. For further details, write for booklet. No obligation. Oakite Products, Inc., 23 Rector Street, New York 6, New York.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

More TECHNICAL BRIEFS

Begins on page 152

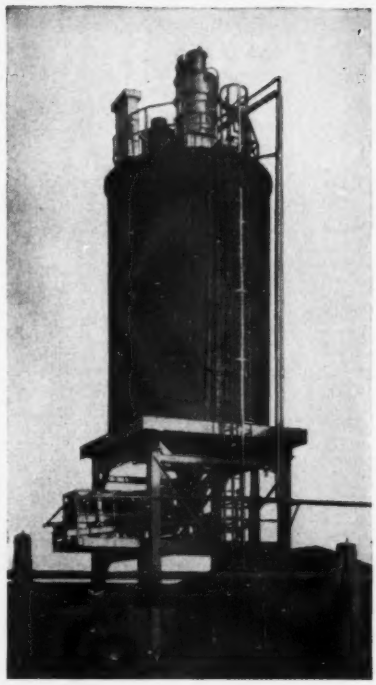
The tube metal temperature is the only true criterion of corrosion and for a particular tube it is determined by the following general factors: cleanliness of tube well, temperature levels and flow intensities on gas and air sides. Once a deposit has formed the value of these factors will change, resulting in a lower metal temperature level and increased corrosion.

A number of curves have been plotted by various sources to indicate the safe metal temperature for various concentrations of sulphur in the fuel and for various types of fuels. Other curves include the effect of the percentage of excess air. Some of these curves are based on the theoretical dew point temperatures, but it has been shown that very minute quantities of sulphur trioxide can produce wide variations in the dew point temperatures. One reference reported that a change of 0.001% in the concentration of sulphur trioxide is sufficient to change the dew point of the flue gas by 40 F. Because sulphur trioxide is the basic source of the corrosion process and because it is impossible to determine what proportion of sulphur in the fuel will eventually be transformed to sulphur trioxide, it is almost impossible to predict a safe value of tube metal temperature for a given set of conditions. *ASME Paper No. 52-A-125.*

Directions for ordering papers on p 154

Announcing the formation of the first supernational European Hydro-Electric Company, the Italian press states that its membership includes Italy, Austria, Germany and France. For the present its chief task is to study a plan common to all for the erection of European hydro-electric power-stations, to lay down the juridical constitution of super-national undertakings thus formed, and to find the means for financing the great works required.

Four motors—two of the largest ever built—for installation in the U. S. Air Force's transonic and supersonic wind tunnel at the the Arnold Engineering Development Ceter at Tullahoma, Tenn., are nearing completion at the East Pittsburgh, Pa. plant of the Westinghouse Electric Corp. The motors—two rated at 83,000 horsepower each and two rated at 25,000 horsepower each—will be installed in tandem fashion. The 83,000-horsepower motors will stand 21½ feet high and weigh 225 tons. Their 122-ton rotors will turn at 600 revolutions per minute. The blades for the compressor measure two feet across the face, are six feet long, and will be mounted on a spindle 18 feet in diameter. Weighing almost two-thirds of a ton each, blades will be solid forgings.



NATIONAL
MEANS
Dependable Low Cost Ash Removal

A survey of your plant by a NATIONAL engineer may reveal that ash removal costs are cutting your profit margin. A survey will cost you nothing . . . may very well boost your earnings.

NATIONAL PNEUMATIC STEAM ASH REMOVAL SYSTEMS

add to the efficiency of your plant in two ways —

1. Exceptionally easy one-man operation means minimum labor cost.
2. Rugged NATIONAL construction means maximum life for parts . . . surprisingly low maintenance costs

It will pay you to investigate NATIONAL'S reputation for delivering satisfaction . . . its complete and effective service policy. Ask us for full information.

NATIONAL CONVEYORS COMPANY, INC.
50 CHURCH ST., NEW YORK 7, N.Y.
Manufacturers of The National ChipVeyor System For Metal Turnings – Furnace Doors – Feeders – Ash Gates and Related Equipment.

free!

This 12-page, 8½ x 11-inch illustrated booklet that explains, in complete detail, how you can simplify and save with

PURE OIL INDUSTRIAL LUBRICANTS

THE PURE OIL COMPANY, U.S.A. PURE

Pure Oil specializes in top-quality *multi-purpose* oils and greases—each one designed to do a number of *different* jobs instead of just one specific job. And do each job *equally well*.

Now we have published a booklet that explains how using these products can help you reduce your lubricants inventory . . . simplify your lubricating procedures . . . minimize waste and error.

Request a copy from your local Pure Oil sales office.* Or use the handy coupon at the right. Do it today!

Be sure with Pure

Sales offices located in more than 500 cities, including: Atlanta Birmingham • Charleston • Charlotte • Chattanooga • Chicago Columbus • Indianapolis • Jacksonville • Madison • Memphis • Miami Milwaukee • Minneapolis • Pensacola • Pittsburgh • Richmond

The Pure Oil Company
Industrial Sales Dept. E-34
35 East Wacker Drive, Chicago 1, Illinois

Please send me your free "Simplify and Save" booklet.

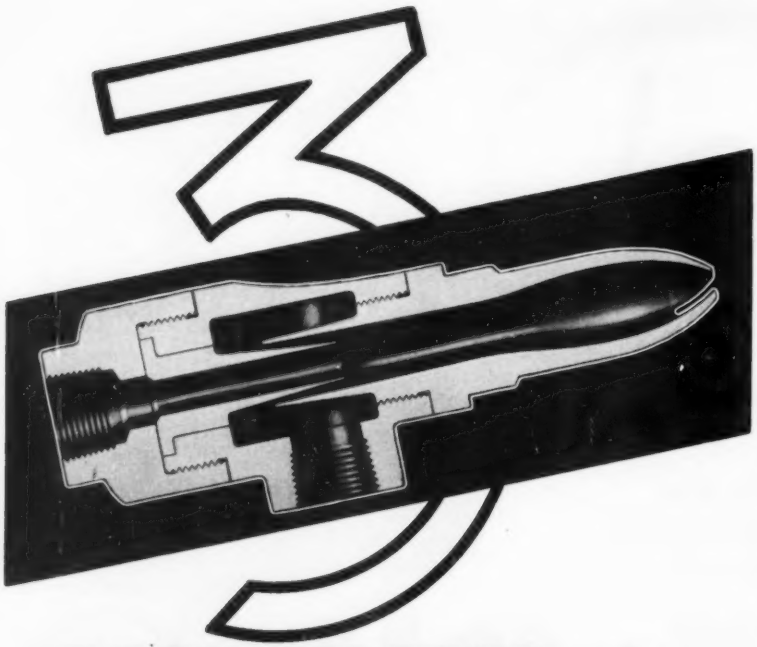
Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____



GOOD REASONS why you should investigate...

NATIONAL AIROIL

TYPE "S-A" OIL BURNERS

1. NATIONAL AIROIL Steam Atomizing Oil Burners *thoroughly atomize* and *completely burn* the lowest and cheapest grades of fuel oil or tar . . . require only minimum supervision and maintenance.
2. Only slight oil pressure and temperature is needed . . . and internal atomizing venturi feature assures low steam consumption.
3. NATIONAL AIROIL Type "SA" Oil Burners are adaptable to all types of industrial heating, power or process furnaces . . . are suitable for firing above stoker grates on conversion to oil.

Other "SA" modifications designed for: the burning of Colloidal fuel ("SAR")—Large capacity operation ("SAL")—Sludge burning ("SAD")—Combined steam and mechanical atomization (DUAL STAGE).

Write for Bulletin 21

STEAM ATOMIZING OIL BURNERS
OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL HEATERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
AIR INTAKE DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1250 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

More FREE BULLETINS

Begins on page 165

16 **MOTOR CONTROLS**—dc automatic controls, ac manual, full and reduced voltage starters, ac relays and contactors, etc. 28 pages. Allen-Bradley Co, 136 W Greenfield Ave, Milwaukee 4, Wis.

17 **DIAPHRAGM MOTOR VALVES**—air operated, single or double seated, 50 psi max working pressure, temperatures to 160 F. 4 pages, Spec Sheet 419-2. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Sta 64, Wayne & Windrim Aves, Philadelphia 44, Pa.

ELECTRICAL EQUIPMENT

18 **FUSES** — renewable time-delay, one-time, plug and copper link fuses, fuse holders. 24 pages, Catalog 16-132. General Electric Co, Construction Materials Div, Bridgeport 2, Conn.

19 **MAGNETIC AIR CIRCUIT BREAKER** — horizontal contact separation, arranged for installation in vertical lift switchgear, rated 4.16 kv. 4 pages, Bulletin 18B6346B. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

20 **INDUSTRIAL HEATERS AND HEATING DEVICES**—spot, strip, dip and fin for almost every heating job. 60 pages, GEC-1005D. General Electric Co, Schenectady 5, N. Y.

21 **RECTIFIER APPLICATION**—question and answer folder. American Rectifier Corp, 95 Lafayette St, New York 13, N. Y.

22 **RHEOSTATS** — complete line of power rheostats for industrial and commercial use. 24 pages, Bulletin 60a. Ward Leonard Electric Co, Mount Vernon, N. Y.

23 **ELECTRICAL TAPES** — with treated paper backing and pressure-sensitive adhesive. 8 pages. Minnesota Mining and Mfg Co, 900 Fauquier St, St. Paul 6, Minn.

24 **CONTROLS, RESISTORS**—carbon, constant impedance, wire wound controls; power rheostats and resistors. 20 pages, Catalog 53. Clarostat Mfg Co, Inc, Dover, N. H.

25 **MAGNETIC MOTOR STARTERS**—with vertical overloads below contactor. 8 pages. Arrow-Hart & Hegeman Electric Co, 103 Hawthorn Av, Hartford 6, Conn.

MAINTENANCE AND SAFETY EQUIPMENT

26 **EYE PROTECTION** — cup type, spectacle and welders goggles; clear, tinted and heat treated lenses. 12 pages, Catalog G-52. Pulmosan Safety Equipment Co, 644 Pacific St, Brooklyn 17, N. Y.

27 **MAINTENANCE, PRODUCTION, SAFETY EQUIPMENT** — anniversary edition. 64 pages, Catalog 29. Martindale Electric Co, Box 617, Edgewater Branch, Cleveland 7, Ohio.

28 **SMALL PRECISION METAL PARTS**—special pins and pivots, screw driver blades, all types of rotary swaged rods, wires and tubing, etc. 4 pages. The Torrington Co, Specialties Div, 500 Field St, Torrington, Conn.

29 **STEEL CHANNELS AND FITTINGS**—all-steel adjustable framing. 44 pages, Catalog 153. Flexa Steel Products, Inc, 1348-50 W Washington Blvd, Chicago 7, Ill.

30 **CONCRETE DENSIFIER**—controls set and reduces water content without increasing air content. 8 pages. Sika Chemical Corp, 35 Gregory Ave, Passaic, N. J.

MATERIALS HANDLING

31 **ELEVATORS AND CRANES**—hand and electrically operated elevators with single, hinged and telescopic uprights; portable cranes with fixed or revolving bases, etc. 36 pages, Bulletin

When Reheat is Considered...

take a close look at this specific Kellogg experience!

To date the company's books show *36* reheat jobs both here and abroad. Some of these have been completed . . . several are underway . . . and others are yet to be started—but they all add up to a major percentage of all reheat systems—including those operating and those to be built.

In addition to this specific experience on complicated reheat jobs, Kellogg approaches each new power piping project with a background that includes the fabrication of piping for scores of main steam installations which are today producing more than 6¼ million KWs . . . and operating at temperatures ranging up to 1050°F . . . and higher. One of the more recent jobs turned out in the Kellogg fabricating shops included the stainless steel main steam piping for a reheat system which will operate at 1100°F and 2350 psig.

The metallurgical "know-how" required to bend this material . . . to weld sections into fault-free sub-assemblies . . . and to accurately heat treat is the result both of experience and specific development work. Kellogg pioneered special welding electrodes and special welding techniques for Stainless 347 . . . and such work is one of the fundamental reasons why Kellogg is specified again and again by important companies for critical power piping jobs all over the world.

These leading companies are among the many major producers of power who use

M. W. KELLOGG POWER PIPING . . .

- American Gas & Electric Service Corp.
- Boston Edison Co.
- Central Hudson Gas & Electric Co.
- Chaudronneries A. F. Smulders (Belgium)
- Compania Argentina De Electricidad
- Compania De Fuerza Del Sureste De Mexico S.A.
- Consolidated Edison Co. of N. Y.

OTHER FABRICATED PRODUCTS including: Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchanger . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings . . . Concrete and Radial Brick Chimneys

FABRICATED PRODUCTS DIVISION
M. W. KELLOGG

KELLOGG — SUBSIDIARY OF PULLMAN INCORPORATED

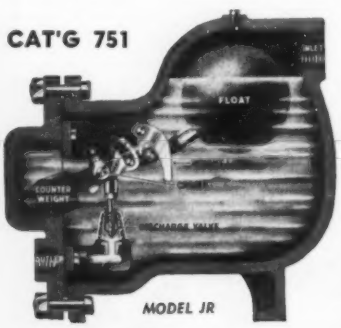
KELLOGG
HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING
KELLOGG
HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING
KELLOGG
HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING
KELLOGG
HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING

NICHOLSON WEIGHT-OPERATED TRAPS

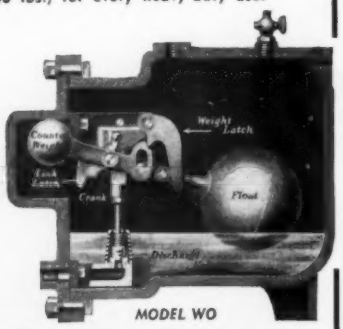
NEVER NEED PRIME

Nicholson weight-operated traps, under no condition, leak live steam. This prevents the costly loss of steam occurring when bucket traps lose their prime as a result of drying up in superheat or flashing at sudden pressure drops. Under these conditions Nicholson weight-operated traps still hold tight because they do not depend on buoyancy of float to raise valve. For purifiers, super-heated lines, headers, separators, heaters, dry kilns, pipe coils, turbine throttle valve drips, stop and check valves, etc. Also for air and gasoline. 3 Types—press. to 200, 500 and 1500 lbs.; for every heavy-duty use.

CAT'G 751



MODEL JR



MODEL WO

125 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

New SHOPPING CENTER Uses FRICK Air Conditioning Throughout

The eleven stores in the big new Freedom Shopping Center in Baltimore, built and owned by Henry J. Knott Enterprises, are all kept cool and comfortable with Frick Unit Air Conditioners. Several of these are tied-in with heaters for year-'round use. Installation by the Paul J. Vincent Co., Baltimore Distributors who have put Frick Air Conditioning in over 100 theatres.

Frick Units, like this one in the Beauty Salon, Air Condition all the Shops at Freedom Center.

Frick Refrigerating and Air Conditioning Equipment can solve YOUR cooling problems equally well. Write

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA U.S.A.

Also Builders of Power Farming and Sawmill Machinery

More FREE BULLETINS

Begins on page 165

5211. Barrett-Cravens Co, 4609 S Western Blvd, Chicago 9, Ill.

32 **SCREW CONVEYORS AND SCREW FEEDERS** — selection tables, hp formulas, layouts, dimensional data. 92 pages, Book No. 2289. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

33 **HEAVY DUTY POWER BELT CONVEYOR**—permanently mounted, reversible direction belt conveyor for inclined or horizontal operation. 4 pages, Bulletin FV-53. The Rapids-Standard Co, Inc, Grand Rapids 2, Mich.

34 **AUTOMATIC COAL SCALE**—construction and operating details, dimensions, information on special features. 16 pages, Bulletin 0352. Richardson Scale Co, Clifton, N. J.

MECHANICAL TRANSMISSION

35 **RIGHT ANGLE DRIVES**—Turbine pump drive and solid shaft gear for centrifugal pumps and industrial use. 8 pages each, Catalogs 20 and 21. Johnson Gear & Mfg Co, Ltd, Berkeley 10, Calif.

36 **TOOTH-GRIP BELTS**—makes positive engagement with grooved pulleys. 8 pages, Bulletin 480. L H Gilmer Co, Tacony, Philadelphia 35, Pa.

37 **RIGHT ANGLE GEAR DRIVE** — designed for vertical turbine pumps where electricity is not available. 8 pages. U. S. Electrical Motors, Inc, P O Box 2058, Los Angeles 54, Calif.

38 **CLUTCHES**—over-running, indexing and backstopping clutches with full complement of sprags. 6 pages. Formsprag Co, 23587 Hoover Road, Van Dyke, Mich.

39 **HERRINGBONE GEAR DRIVES**—single, double and triple reduction drives; double and triple in tandem for space saving. 36 pages, Book No. 2519. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

40 **FLEXIBLE GEAR COUPLINGS**—standard, mill - motor, vertical shaft, floating shaft, spacer and special types. 16 pages, Catalog C 4. Sier-Bath Gear & Pump Co, Inc, 9252 Hudson Blvd, North Bergen, N. J.

41 **ROLLER BEARINGS**—description of component parts, catalog of sizes and capacities, bearing selection chart. 12 pages, Catalog 522. Berliss Bearing Co, 14-18 Carmer Ave, Belleville 9, N. J.

42 **PILLOW BLOCKS** — construction details, dimensions, radial load ratings at various rpm. 8 pages, Bulletin A-620. Dodge Mfg Corp, Mishawaka, Ind.

METERS AND INSTRUMENTS

43 **GAS METERS** — for measuring gases of any type from 4000 to 1,000 000 cu ft per hour; rotary positive displacement. 16 pages, Bulletin M-152. Roots-Connersville Blower, Connersville, Ind.

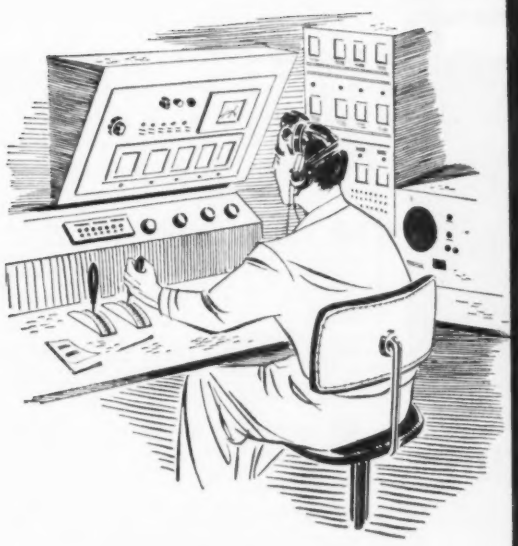
44 **SPEED RECORDERS** — panel mounted, single range, inkless strip chart, 0 to 100,000 rpm, any units. 2 pages, Data Sheet 81M. Metron Instruments Co, 432 Lincoln St, Denver 9, Colo.

45 **AC VOLTAMMETER** — for simultaneous potential and current measurements, 0.2 to 500 amp, 30 to 600 v, 25 to 133 cycles. 1 page, Bulletin 6AA. Associated Research, Inc, 3758 W Belmont Ave, Chicago 18, Ill.

46 **DIAL THERMOMETERS** — with companion 6 in. dial pressure gage. 24 pages, Bulletin 98214. Taylor Instrument Co's, Rochester 1, N. Y.

47 **GAS FLOW METERS**—single, dual or triple mounted, for air or any industrial gas, easily read and maintained, 0 to 1500 cfh. 6 pages, Bulletin 201. Waukee Engrg Co, 759 N Milwaukee St, Milwaukee 2, Wis.

Wear Control



VAN DER HORST
TRADE MARK

Here's a proven way to bracket your Diesel cylinder wear costs and clamp them down to a minimum. The same can be done for compressors.

Just send your worn liners and cylinders to Van der Horst. If they've already been oversized to the limit, that doesn't matter. We can plate them all back to original bore dimensions with VANDERLOY M.

This pure electrolytic iron bonds atomically and can be developed a quarter of an inch thick, if that's essential.

Over the VANDERLOY M we plate PORUS-KROME*. It makes cylinders last as much as four times longer than they did when new and unprocessed.

Then, back they go, ready to give you efficient and dependable service, until at long last they need another Van der Horst processing.

Since the cost for all this is surprisingly less than the price for new, unprocessed replacements, we think you'll want to know more about our wear control method. Why not drop us a line? W52-10

* *PORUS-KROME is a dense, hard, wear and corrosion-resistant chromium, produced by the Van der Horst Corporation of America, and which gives working surfaces an infinite number of tiny oil-retaining reservoirs for perfected lubrication.*

U. S. PATENTS
2,048,578, 2,314,604 and 2,412,698

VAN DER HORST CORPORATION • OLEAN, N. Y.

FOR COAL AND ORE THAWING SHEDS

many

RAILROADS

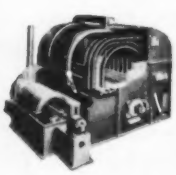
specify LEE

Lee Direct-Fired Heaters have efficiently serviced Thawing Sheds for 30 years giving trouble-free operation.

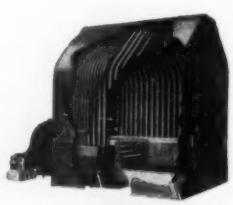
The skill, integrity and responsibility of the entire Lee Corporation is your guarantee of sound engineering.

We maintain a Staff of Engineers to give you complete Lee engineering service and who will furnish data to suit your needs, promptly upon request.

Model BST



Model TSE



Model VTH

LEE

HEATERS SINCE 1918

THERE'S NO HEATING OR AIR-REPLACEMENT PROJECT TOO LARGE FOR LEE HEATERS

SPECIFY LEE the completely engineered heater

LEE CORPORATION

1011 TATNALL STREET, WILMINGTON, DELAWARE

BALTIMORE, MD. CHICAGO, ILL.

More FREE BULLETINS

Begins on page 165

★ **HEAT AND MASS FLOW ANALYZER**—a computing laboratory for heat and diffusion problems; a nonprofit service for industry. ★Request information direct on company letterhead to Dr Victor Paschkis, 624 Engrg Bldg, Columbia University, New York 27, N. Y.

48 **FLOW METERS** — electrical and mechanical evenly graduated, square root flow meters and liquid level meters. Spec Sheets 241 to 247 inclusive. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Sta 64, Wayne & Windrim Aves, Philadelphia 44, Pa.

PIPING, VALVES, FITTINGS, SPECIALTIES

49 **SOLVING STEAM TRAP PROBLEMS** — 36 page manual gives plant-wide selection, installation and maintenance breakdown. Good pointers throughout. Form No. 151. The V D Anderson Co, 1935 W 96th St, Cleveland 2, Ohio.

50 **CAST STEEL VALVES** — globe, angle, check, feed line; stop and bonnet valves; pressure-temperature ratings, etc. 49 pages, Catalog 12-C. Edward Valves, Inc, East Chicago, Ind.

51 **NEEDLE VALVES** — for instrument lines, orifice meters, gages, by-passes, fine regulation of gases and liquids. 4 pages, Circular 568. The Lunkenheimer Co, Cincinnati 14, Ohio.

52 **INTERNAL PILOT REGULATING VALVES**—for on-off control, single-seated straight-through construction. 4 pages, Spec Sheet 404-1. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Sta 64, Wayne & Windrim Aves, Philadelphia 44, Pa.

53 **MERCURY VAPOR ILLUMINATORS** — for steam gages; water column shows blue-green, topped with a brilliant emerald green spot at water level. 2 pages. Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass.

54 **FLEXIBLE METAL HOSE AND TUBING** — seamless and strip wound, fittings and special service equipment. 16 pages, Catalog CC-400. The American Brass Co, American Metal Hose Branch, Waterbury 20, Conn.

55 **SPIRAL WIRE REINFORCED HOSE**—and accessories, for moving air, gases, materials via pressure, suction, gravity; lightweight, strong, flexible. 12 pages, Catalog 35. American Ventilating Hose Co, 100 Park Ave, New York 17, N. Y.

56 **STEEL PIPE AND TUBING**—4-page Bulletin TDC-146 gives mechanical and physical properties, creep strength, welding, fabrication and heat treatment for h-t pipe. Tubular Products Div, Babcock & Wilcox Co, Beaver Falls, Pa.

PUMPS

57 **ALL-PURPOSE CHEMICAL PROPORTIONING PUMP** — built in three models having one, two and three feeding heads, each adjustable independently. 8 pages, File No. 1225. Proportioneers, Inc, P O Box 1442, Providence, 1, R. I.

58 **LOW-CAPACITY CHEMICAL FEEDER**—low-cost treatment for the small water supply. 4 pages, File No. 1910. Proportioneers, Inc, P O Box 1442, Providence 1, R. I.

59 **HOW TO SOLVE PUMPING PROBLEMS**—with rotary gear pumps; gives sample problems, technical data. 36 pages, Form 3060. Geo D Roper Corp, Rockford, Ill.

60 **COOLANT AND LUBRICANT PUMPS**—centrifugal and positive displacement pumps, motor mounting brackets, self-priming auxiliaries and separate tank units. 8 pages, Bulletin 160-26. Pioneer Pump & Mfg Co, 19657 John R St, Detroit 3, Mich.

61 **ROTARY PUMPS** — for manufacturing, marine, petroleum, process industries. 8 pages, Catalog 953. Geo D Roper Corp, Rockford, Ill.

LADISH

Controlled Quality

PIPE FITTINGS

reduce piping assembly time

Makeup goes smoother... with less chance for delay... on those piping systems where Ladish fittings are installed. Ladish Controlled Quality makes the difference. By exacting controls over materials and manufacturing processes... Controlled Quality assures uniform weldability through metallurgical integrity, fast assembly through dimensional accuracy and provides a real assurance of ultimate operating economy and complete dependability... reasons why it pays to specify LADISH.

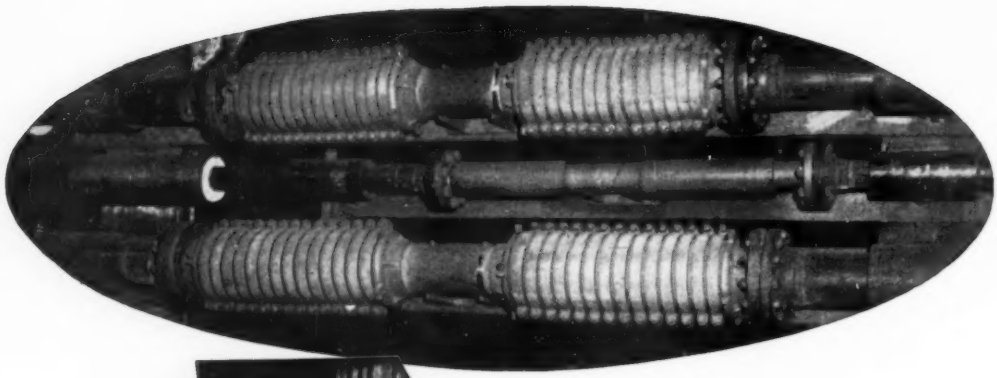
TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • San Francisco • Havana • Mexico City • Brantford, Ont.



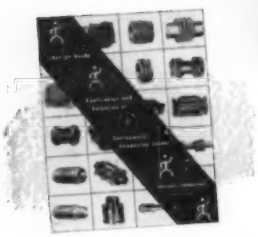
Here's the *Modern way*

to control piping expansion and contraction—

FLEXON

EXPANSION JOINTS

save space . . . require no maintenance . . . save time and money!



Here's your guide to PIPING MOTION CONTROL

The Flexon Expansion Joint Design Guide gives detailed specifications, and selection and application data for Flexon Expansion Joints. Write for your copy or see Flexon Expansion Joint Catalogs in Sweet's, Chemical Engineering Catalog and The Refinery Catalog.

You can have all the advantages of leakproof, maintenance-free pipeline motion control in a compact, easy-to-install, in-line unit when you use Flexon Expansion Joints. There is no repacking . . . no bulky, space-consuming installation . . . just install the Flexon Expansion Joint as easily as putting in a fitting, and then forget it.

Flexon Expansion Joints are offered with stainless steel or copper pressure carriers in Controlled-Flexing, Free-Flexing or Flexoniflex types. Units are available for pressures up to 5500 psi, temperatures to 800° F. (1600° F with special alloys). All types suitable for handling radial, axial and/or lateral pipe motion.

Write for the name of your nearest Flexonics representative.

Flexonics *Corporation*

EXPANSION JOINT DIVISION

1301 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

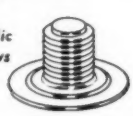
Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Flexible metal hose

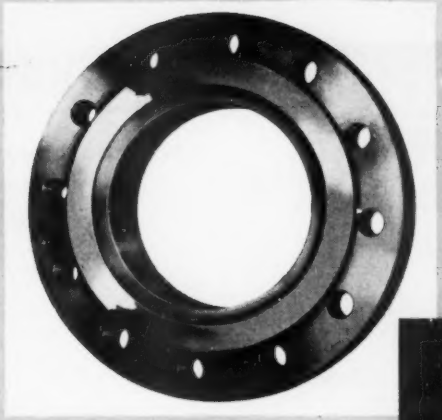
Expansion joints

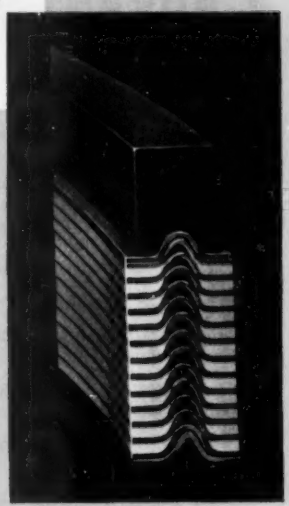
Aircraft components

Metallic bellows



ANKOTALLIC SPIRAL WOUND GASKETS





Withstand even the most severe service conditions for an entire range of pressures.

BRANCHES

BALTIMORE, MD.
BOSTON, MASS.
BUFFALO, N. Y.
CINCINNATI, OHIO
CHICAGO, ILL.
CLEVELAND, OHIO
DAYTON, OHIO
DETROIT, MICH.
HOUSTON, TEX.
INDIANAPOLIS, IND.
LOS ANGELES, CAL.
MILWAUKEE, WIS.
MONTREAL, CANADA
NEW ORLEANS, LA.
NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO, CAL.
SEATTLE, WASH.
SPOKANE, WASH.
ST. LOUIS, MO.
TOLEDO, OHIO
WILMINGTON, CAL.

Ankotallic Spiral Wound Gaskets are made of one continuous strip of preformed metal. They are wound spirally from the inside to the outside with a cushion of filler between each metal ply. In this way it is possible to increase or decrease the number of metal and filler plies, and enable the gasket to survive under severe service conditions and a range of pressures.

It is the preformed U-shaped groove in the metal that provides the safe interlocking feature and creates a type of artificial "lung" that reacts to the existing conditions, be they mechanical compression, temperature changes, or internal pressure variations.

Ankotallic was designed on a principal that has been tried and proved. In no other type of gasket is it possible to vary the compressibility to meet requirements of a pre-designed joint with bolt loading limits already established.

In addition to being able to increase or decrease the number of plies in a given flange area, compressibility of Ankotallic Gaskets is further regulated by taking into consideration the hardness and resiliency of the type of metal specified for the particular service condition.

Various styles of Ankotallic Spiral Wound Gaskets are carried in stock for use on boiler manholes, tube caps, waterwalls, economizers and many other boiler accessories.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.
FACTORIES: MANHEIM, PA. ELKHART, IND. MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

Enco OIL BURNERS

have these

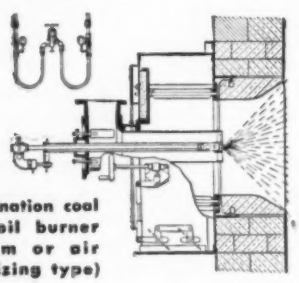
7 ADVANTAGES

in pulverized coal fired boilers . . .

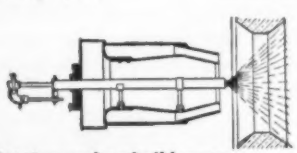
They may be installed in practically all types of pulverized coal burners, with these seven important advantages:

- **They warm up cold furnaces**
- **They ignite pulverized coal—safely**
- **They assure continuous operation in case coal system fails**
- **They provide efficient and safe operation on bank and at low loads**
- **They respond almost instantly to sudden load changes**
- **They permit operation with oil or coal—whichever is available and lowest in cost per BTU.**
- **All capacities of steam, air or mechanical-atomizing types are interchangeable**

The foregoing are only a few of the reasons why Enco oil-burners have been bought by a long list of leading industrial firms. Details of how Enco oil-burners can be adapted to your present pulverized coal burners will be gladly supplied—without obligation. Write The Engineer Company, 75 West St., New York, N. Y.



Combination coal and oil burner (Steam or air atomizing type)



Combination coal and oil burner (Mechanical atomizing type)

Enco Burners

More FREE BULLETINS

Begins on page 165

WATER TREATMENT

62 PACKAGED DEAERATING HEATER—spray-tray type for the smaller steam generating plants, guaranteed to reduce oxygen in heated water to 0.005 ml per liter. 4 pages, Bulletin WC-110. Graver Water Conditioning Co, Dept 10-0, 216 W 14th St, New York 11, N. Y.

63 MONO - COLUMN DEMINERALIZER—fully automatic regeneration, rinsing, recruiting in of effluent and refilling regeneration tanks. 2 pages, MA Catalog Sheet. Penfield Mfg Co, Inc, 19 High School Ave, Meriden, Conn.

An availability of 100 percent was maintained during 1952, the first full calendar year of operation, by the world's first supercharged steam turbine generator. The new generator—a 60,000-kw Allis-Chalmers unit with supercharged hydrogen-cooled rotor—is installed at the Wisconsin Power & Light Co's Edgewater station in Sheboygan, Wis. Out of a total of 8784 hours in 1952, it was in service 8557 to establish a 97.41 percent service factor.

Pacific Gas & Electric Co will continue at full speed in 1953 the construction program it has been engaged in since the end of World War II. During the last year, the company added two new generating units to Moss Landing steam plant to bring its installed capacity to 575,000 kw. Contra Costa steam plant will be raised to equal capacity when installation of two more units is completed in the coming year. Construction of the Pittsburg steam plant, capacity 600,000 kw, is also under way.

Work on a $13.5 million steam plant addition to the Salt River Power District's Kyrene plant has been started with a completion date set for June, 1954. The new unit will more than double the generating capacity of the present 30,000 kw plant put into operation last year.

London — (McGraw-Hill World News) — An open-cycle internal combustion gas turbine to burn peat has successfully completed its initial test runs at the works of the makers, Ruston and Hornsby of Lincoln, England. The 750 kw turbine has been built under contract to the Ministry of Fuel and Power as part of the research program into the utilization of peat resources.

A system of feeding powdered peat into the combustion chamber has been developed which enables the plant to be run as steadily with this fuel as with oil. The plant is now being prepared for prolonged running. The hot exhaust gases are available for drying the peat. The plan is to run the turbine in association with a special press designed to remove about two-thirds of the water from the raw peat, which contains about 90% of water. This system permits peat to be used independently of weather or season, which is in contrast to the conventional methods of air drying.

To help you . . .

Install, maintain and operate electrical equipment

Here are hundreds of detailed descriptions, rules, methods, wiring and practical data.

YOU'LL be able to solve every-day electrical problems right on-the-spot with the help of this guide. It gives you all the usable facts you need for the selection, installation, operation, care and proper application of electrical apparatus and materials. Contains complete data on wires and cables, splicing, installation and care of motors, capacitors, lighting equipment, the latest information on electron tubes and circuits and their application in industry. Imagine how much this information means to you . . . in increasing the number of jobs you can handle, in efficiency, advancement, and time, energy and effort saved.

NEW 7th EDITION

Completely in line with the latest National Electrical Code

Just Out

AMERICAN ELECTRICIANS' HANDBOOK

by Terrell Croft
Revised by CLIFFORD C. CARR
1734 pages, 1327 illus., over 400 tables
$10.00

WITH this trouble-shooting book at your fingertips you'll see how quickly work problems can be simplified. In easy-to-understand language you are given the right facts in the way you want them . . . thoroughly indexed for quick finding. It covers everything from explanations and definitions of fundamentals to suggestions and ways for remedying the troubles of electrical equipment and maintaining high operating efficiency. It presents the kind of practical information that helps all practical electrical men — wiremen, contractors, linemen, plant superintendents, operators, construction engineers and others.

CONTENTS

- Fundamentals of Electricity
- Properties and Splicing of Conductors
- Circuits and Circuit Calculations
- General Electrical Equipment and Batteries
- Transformers
- Electron Tubes and Circuits
- Generators and Motors
- Outside Distribution
- Interior Wiring
- Electric Lighting
- Wiring Tables

10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK CO., Inc.
330 W. 42 St., NYC 36

Send me Croft's **AMERICAN ELECTRICIANS' HANDBOOK** for 10 days' examination on approval. In 10 days I will remit $10.00, plus a few cents delivery or return the book postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

(PRINT)
Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position P-4

This offer applies to U.S. only.

This "Working Heart"

LUNKENHEIMER VALVES

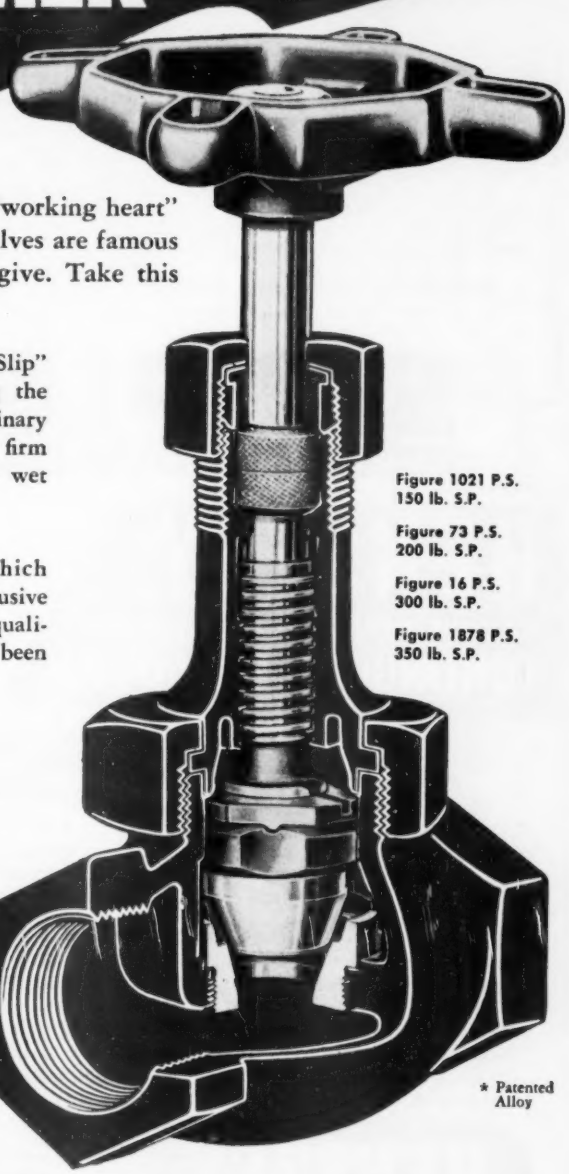


Figure 1021 P.S. 150 lb. S.P.

Figure 73 P.S. 200 lb. S.P.

Figure 16 P.S. 300 lb. S.P.

Figure 1878 P.S. 350 lb. S.P.

Handwheel, stem, and disc . . . these parts are the "working heart" that affects the life of every valve. Lunkenheimer valves are famous for the long, economical service these vital parts give. Take this 200 lb. S.P. "Renewo" Valve, for example:

HANDWHEEL is the new cool-operating "Non-Slip" design that eliminates leakage by enabling the operator to close the valve *tight* with ordinary hand pressure. Four rounded lugs provide a firm grip even when the operator's hands are wet and greasy.

STEM is made of famous "Stemalloy"*, which eliminates stem-thread failure. Amazing exclusive silicon-bronze alloy has exceptional wearing qualities. Millions are in use, and not one has ever been returned due to wear failure.

DISC AND SEAT — 500 BRINELL STAINLESS STEEL — for long, trouble-free service where erosive and corrosive conditions are present. Disc and seat are renewable and can be easily replaced with fullway type seat and disc.

Write for Circular 577, a new bulletin which gives you complete information on the "Renewo" line. And for the finest service on valves, see your Lunkenheimer distributor. The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.

* Patented Alloy

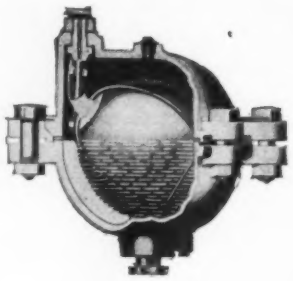
BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-653-13

GET RID OF AIR ACCUMULATIONS IN PIPE LINES...



a BIG Trouble Saver that Costs You LITTLE!

When air lodges at high spots in pipe lines, it reduces the effective area of the pipe, creates a friction head, lowers pumping capacity, and may result in serious water hammer!

Simplex Air Release Valves bring you a sure, efficient cure for these difficulties . . . venting air *automatically before it can cause damage.*

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

IT'S SIMPLEX IT'S ACCURATE

Write for free bulletin to Simplex Valve & Meter Co., 6780 Upland Street, Philadelphia 42, Pa.

SIMPLEX
VALVE AND METER COMPANY

HENSZEY
PACKET-TYPE *Automatic*
CONTINUOUS BLOWDOWN

- Prevents PRIMING
- Prevents FOAMING
- Prevents SLUDGE
- Prevents SCALE

(with simple chemical treatment)

This compact self-contained unit is completely assembled. Can be installed by your own men in hours. It provides completely automatic control of boiler water concentration regardless of variations in boiler load. This is accomplished WITHOUT HEAT LOSS. Maintain clean efficient boilers for substantial savings in fuel, equipment and manpower.

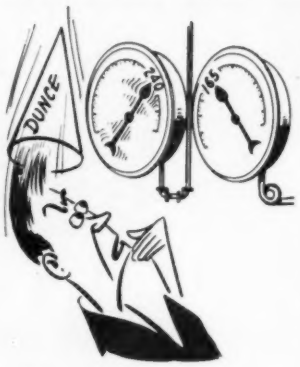
Also...
Standardized or special units for ALL CAPACITIES.

HENSZEY

Consult your nearest HENSZEY Representative for FREE Blowdown Chart or write to

HENSZEY COMPANY
Dept. D4 • Watertown, Wis.

CONTINUOUS BLOWDOWN and BOILER PLANT SPECIALTIES
Boiler Feed Regulators • Distillation Systems • Heat Exchangers • Feed Water Meters
Flow Indicators • Proportioning Valves
Also MILK EVAPORATORS and PREHEATERS



My Biggest Boner

► I GOT MY START in hand-fired plants without automatic controls. In those days every chief I ran into was a safety-valve worry wart. Every time we popped safeties the chief came flying into the boiler room, on the double quick. We were sure to catch it—steam is more valuable in engine cylinders than in the air.

After I got my license I landed a shift-engineer's job. The plant was a beauty with completely automatic controls for stoker, fans and boiler water level. She was a honey to run and I soon forgot the boiler had safeties.

One night my fireman called me into the boiler room to tell me the water level was acting 'funny.' Every time our load shot up, the level almost dropped from sight. When load fell off, level went back to normal. I put more weights on feed-pump governor to jack pressure; it went from 165 to 225 psi.

Climbing around the boiler drum I checked the feed valves but they seemed OK. Something told me we were in trouble so I connected a steam gage to boiler vent line. It showed pressure was 240 psi on heavy loads. Drum gage read only 165 psi.

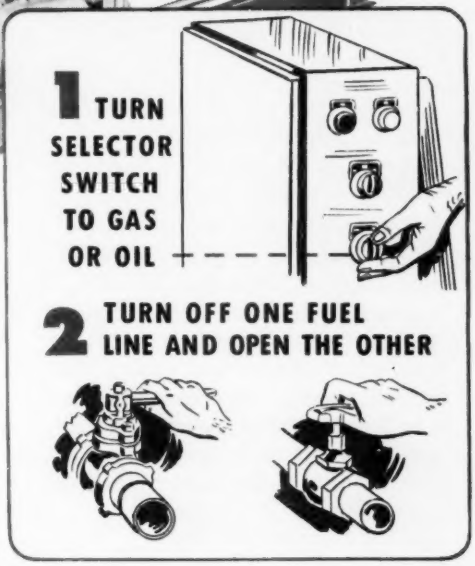
I tried lifting safeties by hand but they wouldn't budge. I yelled to the fireman and we shut that boiler down in a hurry.

After boiler cooled we found safeties stuck shut, steam-gage line plugged, and nonreturn valve jammed in a half-open position. Right then and there I learned that you can't forget ordinary safety practices when boiler is on automatic controls. They do a fine job but the engineer must check safeties every day, blow out steam-gage line and check other parts of boiler at regular intervals.

ART BELTON *Montreal, Canada*

NOW... interchange Gas and Oil firing in *10 seconds*

Modern Cleaver-Brooks Model LR Steam Boiler Equipped with Exclusive Cleaver-Brooks "10-second conversion" Combination GAS and/or OIL Burner



TWO, simple motions eliminate time-consuming change-over

Now you can use oil or gas at the flick of a switch! This exclusive new Cleaver-Brooks development permits changeover from oil to gas or vice versa in only 10 seconds.

That's because the Cleaver-Brooks Combination Gas and/or Oil Fired Boiler operates on gas *with the oil burner in place.* Simply flipping a selector switch on the control panel to either gas *or* oil sets the proper circuit in action. Turning the convenient fuel supply valves completes the entire changeover — and in 10 seconds or less!

To gas users in all parts of the country — and in particular areas where local requirements demand immediate changeover — this exceptional fuel flexibility can be an important factor in determining your overall operating economy.

Ten-second conversion, like 4-pass construction, self-contained design, guaranteed 80% efficiency, is another "plus" feature pioneered by Cleaver-Brooks. It demonstrates Cleaver-Brooks' continuing effort to bring steam users even greater flexibility and reduced operating costs.

If you are considering simplifying your present boiler plant, remember Cleaver-Brooks Combination GAS and/or OIL Fired Boilers. Sizes 15 to 500 h.p. — 15 to 250 p.s.i. Write for complete facts.

Cleaver-Brooks

Originators of the Self-Contained Steam Boiler

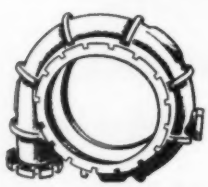
CLEAVER-BROOKS COMPANY
Dept. D, 301 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

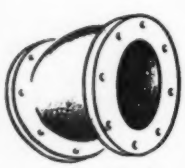
Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

ABK METAL CASTINGS

INCREASE SERVICE LIFE

when used in wet or dry ash handling equipment





In coal-fired stations where proper handling of abrasive ash can save dollars, no better material can be used than ABK Metal.

That's because castings of ABK Metal minimize the destructive wear of abrasive ash and clinker. The controlled structure of this hard nickel-chrome iron (500 to 700 Brinell) means that each unit lasts 4 or 5 times as long as white irons with approximately the same Brinell value in the same service . . . thus reducing downtime and cutting maintenance costs.

Don't let abrasion steal your operating dollars. The next time you have to replace pump casings or impellers, pipes, fittings, liners, or other parts subjected to wet or dry ash abrasion, specify castings in ABK Metal—a Brake Shoe exclusive.

Write Dept. A for Brake Shoe's information folder on ABK Metal Castings.

QUALITY CASTINGS IN

- DUCTALLOY
- MEEHANITE
- ABK METAL

1488

AMERICAN Brake Shoe COMPANY

BRAKE SHOE AND CASTINGS DIVISION
230 Park Avenue, New York 17, N. Y.

APPOINTMENTS

Corporation Executives

E V Huggins has been elected vice-president of corporate affairs for **Westinghouse Electric Corp** by the Board of Directors. This is a newly created position with the Company. Huggins was also elected president of Westinghouse Radio Stations, Inc. At the same meeting, Joseph E Baudino was elected executive vice-president in charge of all operations. Baudino was formerly general manager of all operations.

T A LaBrecque has been elected a vice-president of the **Hilliard Corp,** Elmira, New York. James N Landis of San Francisco has been elected a vice-president of **Bechtel Corp.**

Builders Iron Foundry has elected Earl H Bradley president to succeed Henry S Chafee. Chafee will remain as treasurer of the Company. George W Kelsey was elected president of **Builders-Providence, Inc.**

Charles C Zimmerman, vice-president and chief engineer of the **Benjamin F Shaw Co,** Wilmington, Delaware, was named executive vice-president. Four promotions appeared on **Norton Company's** roster of officers and directors: John Jeppson, formerly assistant secretary and works manager, was appointed vice-president. A Donald Kelso, president of Norton Behr-Manning Overseas, Inc, since last October, became a Norton Company vice-president in charge of foreign operations and a director. Howard J Daly, manager of Bauxite and Crude Abrasive plants was elected to the board of directors. Richard Prouty, formerly assistant to the treasurer, was appointed assistant secretary of the Company.

Election of Fred R Shedd as vice-president of the **Ohio Valley Electric Corp** was announced. He also was named vice-president of the **Indiana-Kentucky Electric Corp,** an O V E C subsidiary. J H O'Brien becomes a treasurer of the **Peoples Water and Gas Co** of Florida. S E Ratcliffe was named treasurer of the **Virginia Electric and Power Co.**

J K Horton has been named president of **Coast Counties Gas & Electric Co,** succeeding H H Farrar, resigned. Francois Roy, member of the transmission-line staff of **The Shawinigan Water and Power Co** since 1915, and mayor of Shawinigan Falls since 1946, has been appointed an assistant vice-president of the company, and appointment of Lester McGillis, manager of purchasing, as an assistant vice-president and manager of the purchasing department is also announced.

Operations Executives

Carl A Boehme has been appointed assistant superintendent of the cold strip department in Campbell works, and Emil A Vierow has been appointed superintendent of the Youngstown district Fuel and Power Department by **The Youngstown Sheet and Tube Co.**

Raybestos-Manhattan, Inc, announces the following appointments: W Ward Kievit, treasurer, succeeding George R

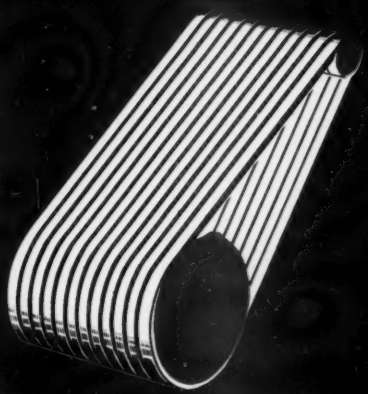
Condor V-Belts–More use per dollar

Condor V-Belts se per dollar

Condor V ollar

Con r dollar

Condor V-Be per dollar

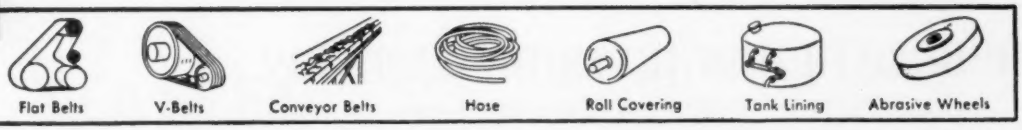


MORE GRIP, LESS SLIP, LONGER LIFE . . . . Yes, you save money with Condor V-Belts on even the toughest multiple belt drive. Straight sidewalls provide more grip, less slip, longer life. They are the smoothest running V-Belts made, because every part is precision-balanced in manufacture. This, too, means longer life. Also in special oil-, heat-, static-resisting types . . . Get the engineering facts. Ask the R/M distributor for Bulletin 6868 . . . He'll tell you, too, how you get MORE USE PER DOLLAR with R/M hose, transmission and conveyor belts.

R M

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

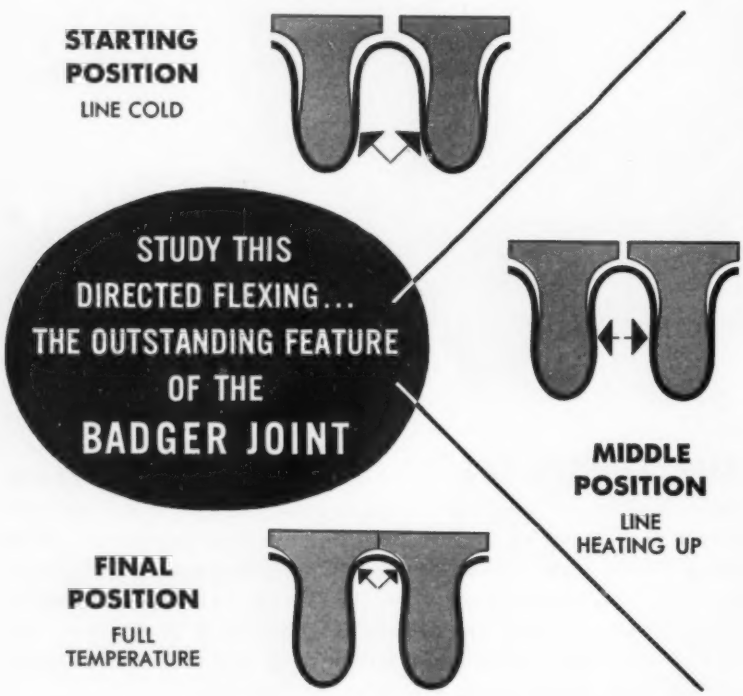


Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls

directed *Flexing*

. . . distributes flexing stresses
. . . multiplies expansion joint life

ON THAT pipe line you are installing, you will want to avoid expansion joint maintenance . . . which means, of course, you will want the packless, corrugated type of expansion joint. And you will want the best functioning, most durable design in the corrugated type of joint.



Note how the corrugation, when hit by the expanding pipeline, wraps itself around the surface of the matching equalizing rings which 'direct' the flexing. Stresses are distributed evenly over all areas of the all-curve corrugations, in contrast with straight-sided corrugations which when flexing move forward and backward as in a plane, concentrating stresses at the top and bottom of each corrugation.

It's this engineering thinking upon which the design of the Badger Expansion Joint is based that is your assurance of buying the best when you buy Badger.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

More APPOINTMENTS

Begins on page 242

Weber recently deceased; William S Simpson, general manager of Raybestos Div at Stratford, Conn., succeeding Robert B Davis recently retired; Osborn H Cilley, general manager of U.S. Asbestos-Grey-Rock Div at Manheim, Pa., succeeding George R Weber; and S R Zimmerman, Jr, assistant general manager of the same division.

Leland D Whitescarver has been appointed manager of marketing for the **General Electric Co's** Medium Steam Turbine, Generator and Gear Department and Raymond B Elmendorf, former Washington, D.C. district representative, has been appointed manager-marketing for the Construction Materials Conduit Products Department. **Bonney Forge & Tool Works,** Allentown, Pa., announces that Thomas G Judd has been named director of advertising and merchandising. Lawrence H Lemke has been appointed general superintendent of **D J Murray Co,** Wausau, Wis.

Appointment of Arthur F Erwin and Edward F Brill as manager and chief engineer, respectively, of **Allis-Chalmers** atomic power section has been announced. P C Smith has been appointed manager of the **Westinghouse Electric Corp's** Transportation and Generator Division at East Pittsburgh, Pa; W R Sugg, Jr, becomes assistant manager of the Division, and G A Moore manager of manufacturing. Carroll B Dick has been appointed manager of the Westinghouse Micarta Division.

Hills-McCanna Co, Chicago, has announced the appointment of V M Barber as advertising manager. Hobart E Switzer has been appointed purchasing agent of the **Electric Regulator Corp,** Norwalk, Conn. Earl D Foster has been appointed superintendent of gas turbine production in **Solar Aircraft Co's** manufacturing division at San Diego.

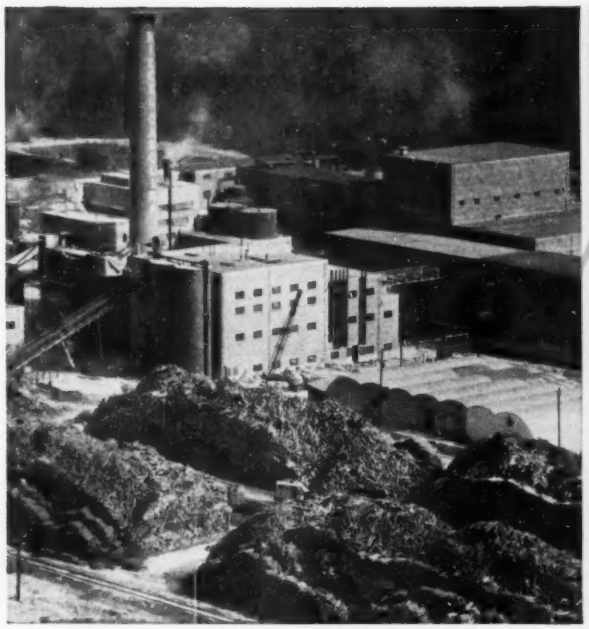
Engineers

Ralph E Clarridge becomes chief engineer for **Taylor Instrument Co,** Rochester, N. Y. Appointment of two men to new posts in the Cleveland Valve Division of **The Parker Appliance Co** is announced. Walter C Loeman, who has headed cost planning for the comptroller has been named Production Manager, and Robert C Dyrenforth will take the post of division engineer. Dr R C Ulmer, formerly technical director of E F Drew & Co, has joined the Engineering Department of **Combustion Engineering-Superheater, Inc.**

Five new appointments to engineering posts at **Allis-Chalmers** Norwood Works have been announced. They are Robert G Bartheld, Richard L McDermott and Walter A Giger, all named application engineers in the electrical section; Walter G Nolte, appointed an assistant engineer in the research laboratory, and Thomas Capizzi, an assistant engineer in the plant engineering department. Earl G Krahn, John F Sellers, Jr, and Claude J Krenzer have been newly named to posts in sections of Allis-Chalmers power department.

The Electric Products Co has announced these new appointments: Dr W A Thomas has been appointed chief engineer,

Oh, I see



. . . they're using our valves at Riegel Carolina . . .

OIC iron valves, steel valves, bronze valves—you see hundreds of them all through this amazing new plant of the Riegel Carolina Corporation near Acme, North Carolina. The OIC Long Line of Valves—proved dependable in years of similar service—enabled Piping Equipment Company of Greensboro, North Carolina, to meet every kind of flow problem in this pulp mill.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1883

VALVES . . . FORGED & CAST STEEL, IRON & BRONZE

ENGINEERED
for
GREATEST
ACCURACY

Lonergan
MAXIMON
PRESSURE GAUGES

Long known for producing pressure gauges of proven dependability and accuracy, Lonergan has made even greater advances in design and construction with the line of Maximon Gauges. This series of premium-specification gauges are AA grade and meet the demand for applications requiring highest standards of instrumentation. Sizes range from 4½" through 12". The line includes gauges for a broad group of services including steam, water, air, oxygen, oil, distillates, high pressure steam, etc. Various constructions provide for both corrosive and non-corrosive conditions.

Full details about the complete line of Lonergan Maximon Gauges as well as our standard line of gauges is given in our Catalog 800G—write for a copy or ask your regular Lonergan distributor.

TO BE SURE OF COMPLETE PROTECTION install
Lonergan
Safety-Relief Valves

A full line is available to meet every requirement. Send for Catalog 800V for complete details.

Lonergan
J. E. LONERGAN COMPANY
Race and Second Sts., Phila. 6, Pa.
Over 80 years experience

More APPOINTMENTS

Begins on page 242

E D Smith is now consulting engineer, J J Unger becomes manager of electrical engineering, J R Williams has been appointed manufacturing manager and R H Worby has been appointed chief industrial engineer.

Dr Cyril G Veinott, well known electric motor design engineer, inventor and author, has joined the **Reliance Electric & Engrg Co,** Cleveland, O., as consulting engineer on ac machinery. The appointment of Sidney P Thomas to the **Monsanto Chemical Co-Union Electric Co of Missouri** atomic electric project was announced today. He will serve as a chemical engineer.

John H Kilmer, Jr. is named chief engineer, and Paul A Brauer, assistant chief engineer in charge of production of **Golden-Anderson Valve Specialty Co,** Pittsburgh, Pa. The appointment of Dr Sylvan Wallach as senior scientist on reactor design development for **Walter Kidde Nuclear Laboratories** was announced.

Sales Managers and Personnel

Announcement is made by **Iron Fireman Corp,** Cleveland, Ohio, of the promotion of S H Beach to industrial sales manager for the United States, and D Paul Bailey to the post of assistant sales manager.

O B Wilson has been named industrial instruments sales manager, Devon W Fryback has been named sales manager of the Eastern region, and J A Robinson is made field manager for the Industrial Division: while Frank Day, Vincent Lo Scalzo and V L Evans have recently been assigned to field sales posts for the Valve Division of **Minneapolis-Honeywell Regulator Co.**

William L Manly, for the last several years special assistant to C W Schweers, vice president and director of sales at **Allis-Chalmers** General Machinery Div, has been named assistant director of sales of the division.

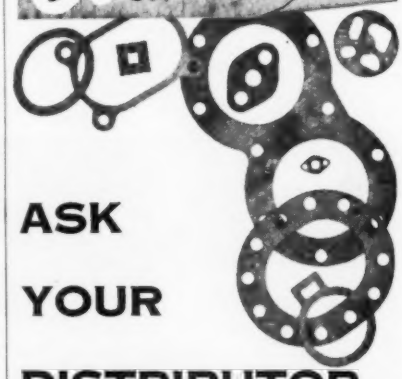
Five new assignments in the electrical wire and cable department of **United States Rubber Co** are announced: John Blake is manager of state and municipal sales, and E T Corbus manager of electrical utilities sales. J W Loveland is now eastern division sales manager, succeeding Corbus. C R Pickens will be the southeastern divisivison sales manager, located at Atlanta, and H J Cluver will be the middle-Atlantic division sales manager, with headquarters at Philadelphia.

The appointment of E A Warren to the sales engineering staff of **Honan-Crane Corp,** Lebanon, Indiana, has been announced. C L Petty, Jr has been appointed district sales manager of the Philadelphia office of the **A P Green Fire Brick Co,** Mexico, Missouri. Leonard P Mellgren becomes district sales engineer and will head the **De Laval Steam Turbine Co's** new district offices in Minneapolis, Minn.

New Sales Offices, Personnel

The Foxboro Co has opened a new branch office at 2207 South Pinecrest, Wichita, Kansas. Appointed resident engineer is Dale G Hugley, who moves to his

BELMONT
Gaskets



ASK
YOUR
DISTRIBUTOR

It's astonishing how much there is to selecting the right gaskets for even a modest range of services and service conditions. That doesn't mean that to get maximum efficiency and economy from your various seals you have to become an expert yourself. Fortunately for this time of accelerated activity and pressing responsibilities, you can solve this problem once and for all by making a simple telephone call to your BELMONT gasket distributor. He has the knowledge and the precise materials to assure you of reduced maintenance and uninterrupted production wherever joint and surface sealing is critical.

Ask a BELMONT distributor . . . he knows!

Or, write on your company letterhead for catalog

4-04-A

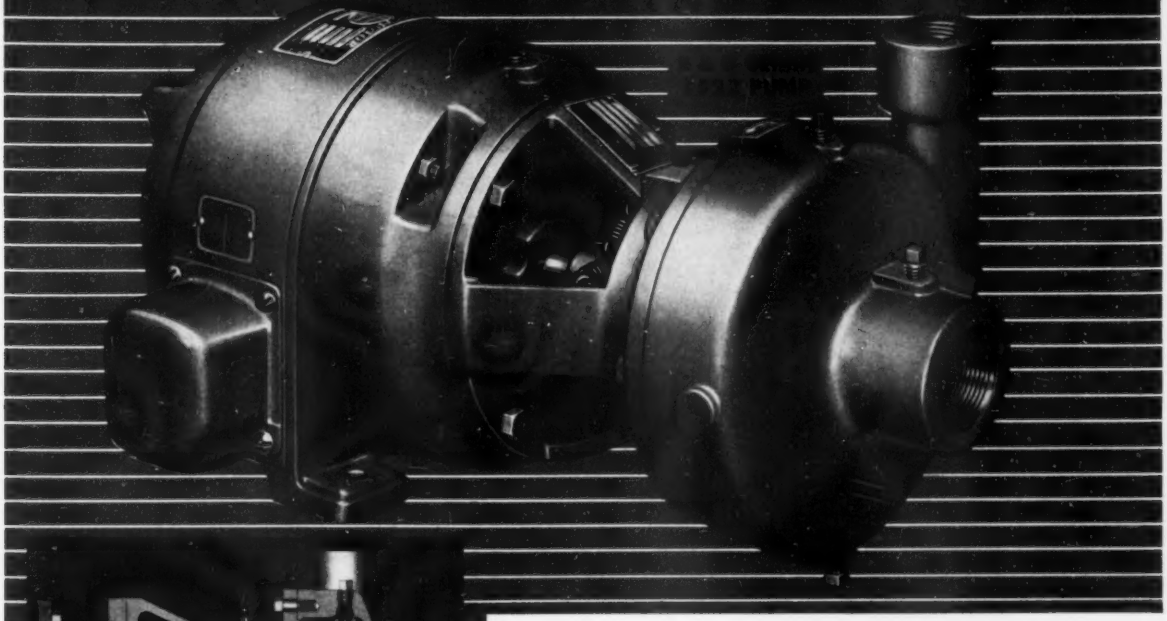
for Steam • Water • Oil • Gas • Air
Acids • Alkalies • Ammonia

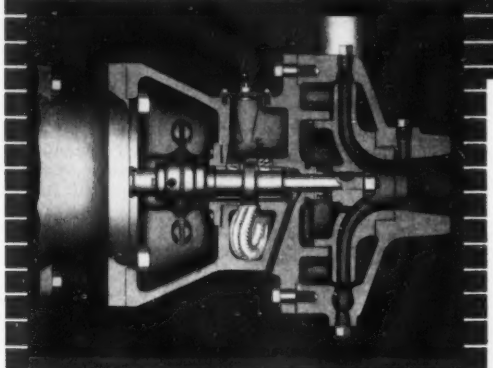
THE
BELMONT
PACKING AND RUBBER CO.
Butler and Sepviva Streets
Philadelphia 37, Pennsylvania

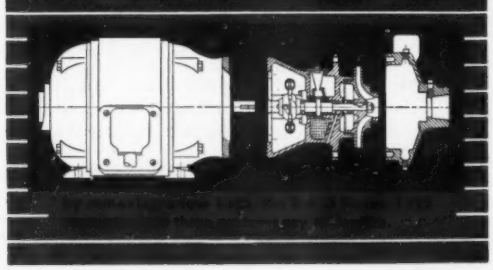
Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets
There's a Belmont Packing for every service

Worth looking into...

SEE THE 8 REASONS WHY B & G SERIES 1522 PUMP DOES A BETTER JOB







When you check into these design features, it's easy to understand why B & G Series 1522 Pumps are making performance records...

First: Leak-proof Mechanical Seal—ends stuffing box troubles.

Second: Spring-type flexible coupling—contributes to unusually quiet operation.

Third: Dynamically balanced impeller.

Fourth: Easily serviced. Removal of a few bolts permits separation into three parts.

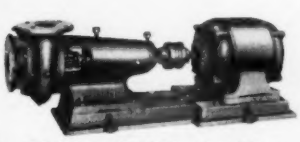
Fifth: Interchangeable parts. The bearing bracket sub-assembly, including shaft and sleeve bearings, is manufactured to close tolerances and is interchangeable in all B & G 1522 Pumps.

Sixth: Shaft alignment maintained by oil-lubricated, high grade bronze sleeve bearings.

Seventh: Standard motors—easily obtainable from motor manufacturer's stocks.

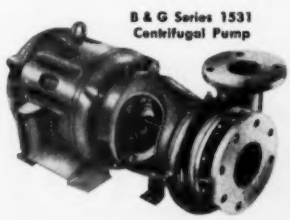
Eighth: With all these features, B & G Pumps are *competitively priced!*

Don't delay—get the facts *now* on B & G Centrifugal Pumps.



B & G Series 1510-15 Centrifugal Pump

B & G Series 1531 Centrifugal Pump



Send today for catalogs giving descriptions and selection data for B & G Centrifugal Pumps.

Heat Exchangers . . . Water Heaters
Pumps . . . Refrigeration Equipment
Forced Hot Water Heating Systems

BELL & GOSSETT

COMPANY

Dept. CX-36, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto

VOLTROL VANE CONTROL MECHANISM

LEVER FOR CAPACITY REGULATION (Suitable for attachment to Combustion Controller)

VOLTROL (Volume Control) VANES giving Capacity Regulation down to 10% of Max

AIR STRAIGHTENING VANES

FULLY ENCLOSED DUST-PROOF MOTOR

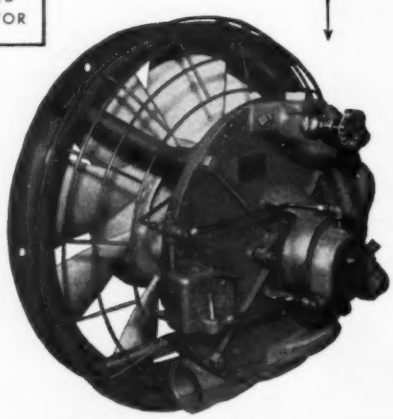
WINGFOIL AXIAL FLOW FANWHEEL—Highly Efficient. Mounted directly on Motor Shaft

WING FORCED DRAFT BLOWERS

•

Type EMD Motor Driven Axial Flow Blower

Type R Turbine Driven Axial Flow Blower

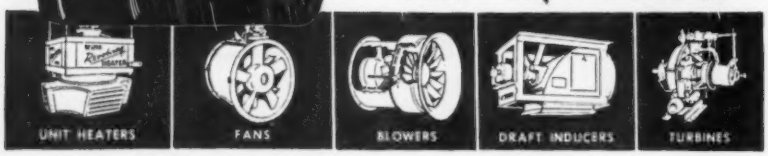


Wing Forced Draft Blowers are available in Motor Driven, Single Stage (EMD) or Two Stage (COM) Models or in Turbine Driven Models (Type R for Windbox Mounting or Type K for Brick Wall Mounting).

Write for a copy of Bulletin SW-1a

Wing

L. J. Wing Mfg. Co.
50 Vreeland Mills Road
Linden, New Jersey
Factories:
Linden, N.J. and Montreal, Canada



More APPOINTMENTS

Begins on page 242

new assignment after several years with the Tulsa branch as industrial engineer. B F Benning has been appointed manager of the Shreveport branch of the **Graybar Electric Co,** succeeding A W Wheeler, who has been made manager at New Orleans.

Bailey Meter Co, Cleveland, Ohio, announces the appointment of A L Danielson as manager of their branch office in Denver, Colorado, located at 1506 Kearney St. He succeeds G M Wallace, who has been appointed an assistant sales manager with headquarters in Cleveland. The **Hammel-Dahl Co** of Providence, R. I., announces the opening of two California offices. Both offices will be under the supervision of Thomas H Ponton. The Los Angeles office is at 3715 Santa Fe Ave and in San Francisco, 607 Market St.

New Distributors, Representatives

The appointment of Florida Metals, Inc, 2937 Strickland St, Jacksonville, Florida, as a distributor of industrial tube fittings and tube fabricating tools manufactured by **The Parker Appliance Co,** Cleveland, is announced. **Copes-Vulcan Div,** Continental Foundry & Machine Co announces the appointment of Gil Moore & Co, 714 West Olympic Blvd, Los Angeles 15, California, as representaitves for Copes-Vulcan Products.

H L Cahan has been appointed district representative for **General Electric's** Construction Materials Div. He will be responsible for the Wire and Cable Department's products in the Los Angeles area with offices at 3000 East 46th St, Los Angeles. **Taco West Corp,** Chicago, announces that Control Equipment Company of Atlanta will represent Taco West in Georgia, eastern Tennessee, Alabama and northern Florida. It is located at 1222 Peachtree Street, N.E., Atlanta.

Three new representatives are announced by **Farr Co** of Los Angeles. They are the Johnson Filter Sales Co, Cleveland, Ohio, the Pittsburgh Air Filter Service Co, Pittsburgh, Penn., and Air Filter Sales & Service-Detroit, Detroit, Mich. General Combustion Co, 339 Brown Marx Bldg, Birmingham 3, Alabama, is the new district representative of **Eclipse Fuel Engrg Co,** covering the states of Alabama and Northwestern Florida.

Atlas Chain and Mfg Co, Philadelphia, has appointed Warren M Pike Associates, Inc, 274 Franklin St, Boston 10, Mass., as master distributors of Atlas Chain for the metropolitan Boston area. Appointment of Thomas F Sears Co, 4085 Valerie, Bellaire, Texas, as exclusive representative of Texas and Louisiana is announced by **Pioneer Pump,** Div of Detroit Harvester Co, Detroit, Mich.

Three new distributor appointments are announced by the Instrument Division of **Stewart-Warner Corp.** They are: The Alemite Co, 64 Cummington St, Boston 15, Mass.; Stewart-Warner Alemite Sales Co, Locust Street, Hartford, Conn., and, The Alemite Co, Inc, 622 Cherry St, Des Moines, Iowa. **Oxy-Catalyst, Inc,** Wayne, Pa., has

You've got a Winning Combination

A STANDARD ISA FACE-TO-FACE DIMENSIONS
K "FLOW-LINE" CONTOURED BODY
Q STELLITED SEATING SURFACES
J RENEWABLE SELF-ALIGNING GUIDES
10 SEAT RINGS EASILY REPLACED WITH VALVE IN PIPE LINE

with the New

TRADE **LESLIE** MARK

DOUBLE SEATED DIAPHRAGM CONTROL VALVES

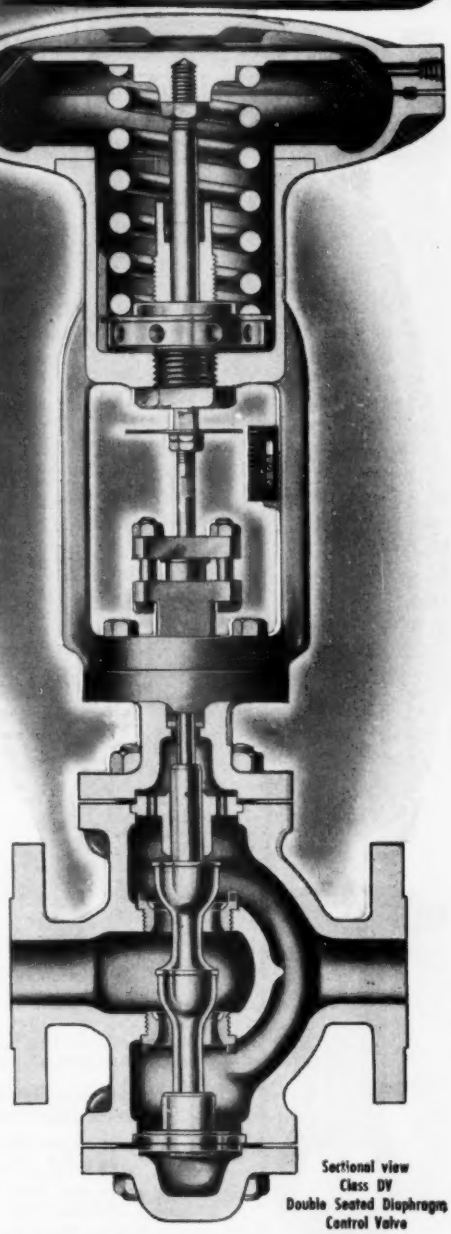
Calling a spade a spade you've got a "royal flush" of features in these new Valves designed for use with control instruments.

Their "Flow-Line" Contoured Bodies have ISA standard face-to-face dimensions and high capacity, low turbulence and minimum body pressure drop characteristics.

A new type, top and bottom guided construction is self-aligning and non-binding regardless of uneveness of bolt tightening.

Standard, integral stellited seating surfaces are recommended for steam service to reduce seat ring thread corrosion. Renewable, interchangeable seat rings also furnished where desired and may be easily replaced without removing valve body from the line. Elaborate grinding at high temperatures is completely eliminated.

With these Valves, you get as *standard equipment,* features heretofore only obtainable in expensive, specially designed valves.



Sectional view
Class DV
Double Seated Diaphragm
Control Valve

***WRITE FOR* Bulletin 513**

ESTABLISHED 1900
LESLIE CO.
1707

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

Albany, N. Y.	Chicago, Ill.	Galveston, Tex.	Memphis, Tenn.	Orlando, Fla.	Salt Lake City, Utah
Albuquerque, N. M.	Cincinnati, Ohio	Greenville, S. C.	Miami Springs, Fla.	Philadelphia, Pa.	San Francisco, Calif.
Atlanta, Ga.	Cleveland, Ohio	Houston, Texas	Milwaukee, Wis.	Pittsburgh, Pa.	Seattle, Wash.
Baltimore, Md.	Dallas, Texas	Indianapolis, Ind.	Minneapolis, Minn.	Ponca City, Okla.	St. Louis, Mo.
Beaumont, Tex.	Denver, Colo.	Kansas City, Mo.	Mobile, Ala.	Providence, R. I.	Syracuse, N. Y.
Birmingham, Ala.	Des Moines, Ia.	Kingsport, Tenn.	Monroe, La.	Richmond, Va.	Tucson, Ariz.
Boston, Mass.	Detroit, Mich.	Los Angeles, Calif.	New Orleans, La.	Rochester, N. Y.	Wilkes-Barre, Pa.
Bridgeport, Conn.	El Paso, Tex.	Louisville, Ky.	New York, N. Y.	Rutherford, N. J.	Wilmington, Calif.
Buffalo, N. Y.					Youngstown, Ohio

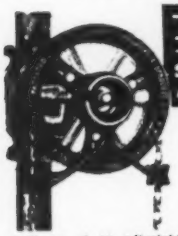
Bruxelles-Forest, Belgium

Montreal, Que., Can. • Ottawa, Ont., Can. • Toronto, Ont., Can. • Vancouver, B. C., Can. • Welland, Ont., Can.

235 Grant Avenue, Lyndhurst, New Jersey

FLOATLESS LEVEL CONTROLS • PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
• AIR HORNS • STEAM WHISTLES

FOR SAFETY'S SAKE
Control Valves from the Floor



Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

ELIMINATES
STEP-LADDER
CLIMBING
RISKS

● Range of 10 adjustable sizes take care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

● Climbing on benches, machines, boilers or treacherous stepladders to control overhead valves is absolutely unnecessary, foolish risking of life and limb. Why permit such risks when the safe and sure BABBITT Adjustable Sprocket Rim with Chain Guide is available at such low cost? Overhead valves are conveniently and safely operated right from the floor!

● The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

● *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

MARTINDALE
PROTECTIVE MASKS

PLACE HEAD BAND WELL UP AROUND HEAD TO KEEP FROM SLIPPING DOWN
PRESS NOSE TABS IN CLOSE AGAINST FACE TO HOLD PAD AGAINST THE NOSTRILS
PRESS EDGES OF FACE PLATE DOWN TO FIT FACE SNUGLY

Weigh Less than ½ ounce.

Clean, cool, comfortable. Excellent protection against non-toxic dusts except free silica. Replaceable cotton pads are inexpensive and sanitary.

Martindale Protective Masks.....$.30 ea.
No. 1 Refills (Standard weight)..... .02 ea.
No. 2 Refills (heavyweight)..... .02½ ea.

Masks packed individually. Refills packed 25 to envelope. No. 2 (heavyweight) Refills contain twice as much filtering cotton as No. 1.

DISCOUNTS

Less than $10.00 list.....Net
$10.00 to $24.99 list.....10%
$25.00 to $99.99 list.....15%
$100.00 and over.....20%
Minimum, charge account or C.O.D.....$2.00
Minimum, cash with order.....$1.00

If payment accompanies order we will pay parcel post or express charges.

MARTINDALE ELECTRIC CO.
1385 Hird Ave. Cleveland 7, Ohio

Sensitive
PRESSURE CONTROL
for Steam, Air or Gas

Here is the Davis diaphragm motor valve with pressure controller that gives you accurate control for pressure reducing, pressure relief or back pressure service on steam, air, or gas!

- **Panel or valve mounted controller. Quick, easy, adjustment for change of pressures.**
- **Spring loaded balanced V-port or quick opening inner valve — Direct or reverse acting.**
- **Bronze, semi-steel or steel body. Bronze or stainless steel trim.**
- **Sizes ½ to 14". For indoor or outdoor installation.**
- **Initial pressures to 1500 p.s.i. Reduced pressures from 1000 p.s.i. to 1 p.s.i.**

Investigate the Davis No. 401 Regulator. When inquiring state service, size, pressure and temperature conditions. Ask for complete information.

Davis
DAVIS REGULATOR COMPANY

2540 SOUTH WASHTENAW **CHICAGO 8, ILLINOIS**

More APPOINTMENTS

Begins on page 242

appointed Dravo Corp, Pittsburgh, Pa., as sales and engineering representative for its Oxycat, an air pollution-control and heat-recovery device.

New Names, Purchases, Addresses, Etc

John J Somes, who has represented **The Terry Steam Turbine Co** in the Chicago district since 1934, has formed a partnership with Gus Nick. **Somes & Nick Co** will represent Terry in the sale of steam turbines and gears in Chicago. A M Sargent, founder and former president of the **Pioneer Engrg and Mfg Co,** who recently resigned his interest in that firm, announced he had opened his own consulting engineering office at 10120 West McNichols Road, Detroit 21. **Golden-Anderson Valve Specialty Co,** Pittsburgh, Pa., has acquired the shop and equipment of Imperial Machine Works, Inc.

Division Lead Co announced their purchase of the Eagle-Picher Co, Metallic Products Division plant at Argo, Ill. **Whiting Corp** announces the removal of its St. Louis district sales office from 3238 Olive Street, St. Louis, to 567 North and South Road, University City 5, Missouri. The Lull Mfg. Corp, Minneapolis, has been purchased by **The Baker-Raulang Co,** Cleveland. T A Marsh retired December 31, 1952 from **Iron Fireman Corp,** and is now conducting a consulting service on smoke abatement and fuel economy at 1076 Rosalie Ave, Lakewood 7, Ohio.

Internal Changes

A new plant extension by **The Foxboro Co, Ltd,** at Montreal has more than doubled its instrument manufacturing facilities in Canada. What has been known as Heating Control Division of **Iron Fireman Mfg Co** will now be designated the Electronics Division. The **Babcock & Wilcox Co** has purchased a tract of land south of the city of Wilmington, N. C., and will start immediately to erect a new $2,000,000 plant to build boilers and related equipment.

The Small and Medium Motor Department of the **General Electric Co** has been discontinued and its operation has been decentralized into three new product organizations. A divisional marketing department was also established to facilitate a unified approach to all division marketing policies. The four new departmental organizations and their managers are: Marketing Department, Walker H Henry, manager; Medium Induction Motor Department, Olaf F Vea, general manager; Direct Current Motor and Generator Planning Study, Oscar L Dunn, manager; and Synchronous and Specialty Motor and Generator Department; Fred B Hornby, general manager.

Beckman Instruments, Inc, broke ground for a new two million dollar, 200,000 square foot instrument factory and administrative offices to be erected on a 40-acre site between Ocean Ave and Imperial Blvd on Highway 101 in the La Habra-Fullerton area, California.

Societies, Schools, Foundations

Elgin B Robertson, president of Elgin B

Dave O'Leary, Shop Superintendent, and Joe Koehn, Fitting Shop Foreman, look over a blueprint in the Heyl & Patterson Fitting Shop. Both men are 30-year veterans with Heyl & Patterson.

"Old Pros" with the "FOLLOW THROUGH" that counts!

The "Follow-Through" is one of the many ingredients that contributes to the successful performance records of Heyl & Patterson designed, fabricated and erected equipment. Here is a picture snapped in the Heyl & Patterson Fitting Department. It's a "natural" showing how our shop men "follow-through" from the original designs of our Engineering Department. Compare the picture of these "Old Pros" with the "Follow-Throughs" you have seen on TV in batting scenes from the World Series in baseball and the important winning forward passes in pro-football games. The Heyl & Patterson "follow-through" is possible because we have our own Engineering Department, our own Fabricating Department, our own Machine Shop, our own Erection Department.

The H & P Engineering Department calls the signals and the other H & P Departments know how to "Follow-Through." This is why Heyl & Patterson can guarantee long-life, low-cost performance of Heavy Bulk Materials Handling Equipment.

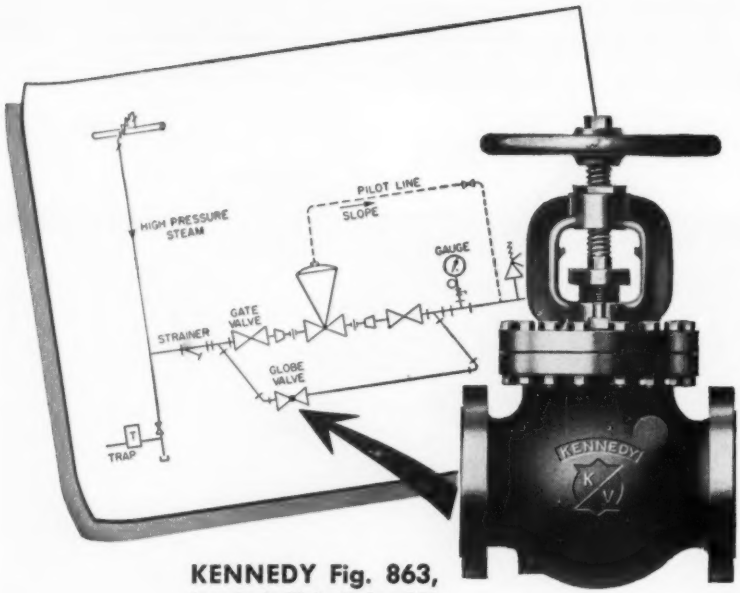
Heyl & Patterson, Inc.

"SINCE 1887"

55 WATER STREET · PITTSBURGH 22, PA

Heavy Bulk Materials Handling Equipment

All The Way from Design to Erection



KENNEDY Fig. 863,
Iron-Body Globe Valve. 250 pounds of steam at 500°F.

Here's how to set up pressure-reducing lines for easier maintenance

You naturally don't want to shut down a vital part of your operation when you repair a single valve.

You can avoid doing so by installing a by-pass around your pressure-reducing valve and installing a globe valve in the by-pass line. With this set-up you can use the globe valve for hand throttling when the reducing valve is removed from the line for repairs.

KENNEDY JOB-FITTED IRON-BODY GLOBE VALVES are designed and constructed for high pressures and severe service on steam or water lines and for heavy-duty service with oil, gas and other fluids that do not corrode bronze or iron.

Individual valves in the KENNEDY JOB-FITTED line are specially designed with the proper disc and seat trim to match the service for which they are recommended. Valves with either renewable composition or bronze faced discs are available, depending on the pressure in the line.

REPACK UNDER PRESSURE—You can repack ALL KENNEDY iron-body globe valves under full line pressure when wide open.

THE COMPLETE LINE of KENNEDY JOB-FITTED valves and INSPECTED fittings is sold through local distributors who are in a position to give you fast and convenient service.

THE **KENNEDY**
VALVE MFG. CO. • ELMIRA, N.Y.
Est. 1877
VALVES • PIPE FITTINGS • FIRE HYDRANTS

More APPOINTMENTS

Begins on page 242

Robertson, Inc, Dallas, Texas, has been nominated for the presidency of the **American Institute of Electrical Engineers.** The announcement followed a report of the Institute Nominating Committee during the Winter General Meeting at the Hotel Statler. The following were nominated for the office of vice-president, representing districts of the Institute in various parts of the country. Walter B. Morton, station electrical engineer, Pennsylvania Power and Light Co, Allentown, Pa.; C P Almon Jr, chief, Power System Operations Division, Tennessee Valley Authority, Chattanooga, Tenn; A S Anderson, manager, electric utility sales, Apparatus Sales Division, General Electric Co, Inc, Denver, Colo.; George C Tenney, editor, Electrical West, McGraw-Hill Co, Inc, San Francisco, Calif; G D Floyd, system planning engineer, Hydro-Electric Power Commission of Ontario, Toronto, Ont., Canada.

Those nominated as directors were: T M Linville, manager, development services, General Electric Co, Schenectady, N. Y.; E W Seeger, vice-president in charge of development and assistant secretary, Cutler-Hammer Inc, Milwaukee, Wis.; Donald I Cone, transmission & protection engineer, Pacific Telephone & Telegraph Co, San Francisco, Calif. Walter J Barrett, electrical coordination engineer, New Jersey Bell Telephone Co, Newark, N. J., was also nominated for treasurer.

R A O'Brien, assistant to the chairman of the mechanisms and dynamics department at Armour Research Foundation of Illinois Institute of Technology, has been appointed to a research committee that will study the plasticity of metals by the **American Society of Mechanical Engineers.** The **American Society of Civil Engineers** has announced the appointment of Harold T Larsen as manager of technical publications. He succeeds Sydney Wilmot, who has retired.

Obituaries

W Vernon Brumbaugh, 57, executive secretary of the Refrigeration Equipment Manufacturers Association of Washington, D.C., Feb. 14 in Bethesda, Maryland.

Louis K Doutrick, 60, retired vice-president of Arizona Public Service Co, Jan. 27 in Phoenix, Arizona.

Charles Arthur Booth, 76, executive vice-president of Buffalo Forge Co, after a short illness in Buffalo.

Thomas S Green, 66, a former director of Norton Co, Jan 25, in Albany, N. Y.

George R Weber, vice-president, treasurer and a director of Raybestos-Manhattan, Inc, and general manager of its U.S. Asbestos Div plant at Manheim, Pa., Jan 14 in Lancaster, Pa.

Harold A Dambly, 53, engineer in charge of the Testing Div for Philadelphia Electric Co, Jan 15 in Philadelphia.

George William Abel, 64, general superintendent of the steel plant at Indiana Harbor Works, Youngstown Sheet and Tube Co, Jan 12 in Chicago.

FIRST *complete* packaged boiler

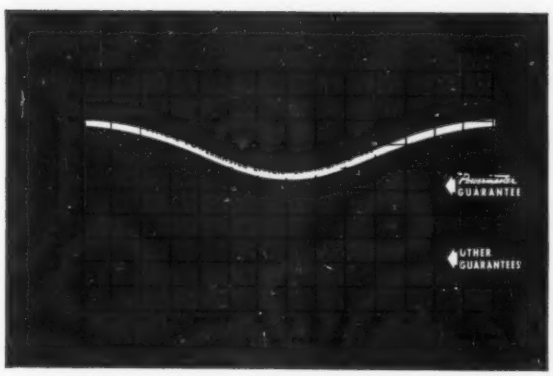
FIRST full modulating cam control

FIRST *Voriflow* air-atomizing burner

FIRST immediate change-over—oil or gas

NOW—*Powermaster*® is FIRST to guarantee 83% minimum efficiency

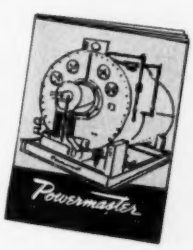
The "pay-off" on a boiler is its operating efficiency . . . and *only Powermaster guarantees a minimum of 83%* with No. 6 oil!



Take a look at the typical efficiency curve of *Powermaster* shown here . . . then compare A.S.M.E. tests with those of any other boiler. At less than full load (which is normal in field operation) notice that *Powermaster* efficiency actually *increases.*

There's a reason for such efficiency. The *Powermaster* is the development of 68 years' experience in boiler manufacture. Continuing research and progressive engineering have resulted in *Powermaster* users being the first to benefit from major improvements in packaged boiler design.

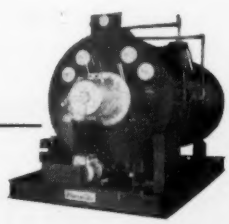
Point-by-point, *Powermaster* welcomes comparison. Before deciding on a new boiler for your plant, be sure to get the facts on the newest *Powermaster* with *Voriflow* combustion. Just drop us a line and we'll be glad to send you our new catalog.



Powermaster®

PACKAGED AUTOMATIC BOILERS

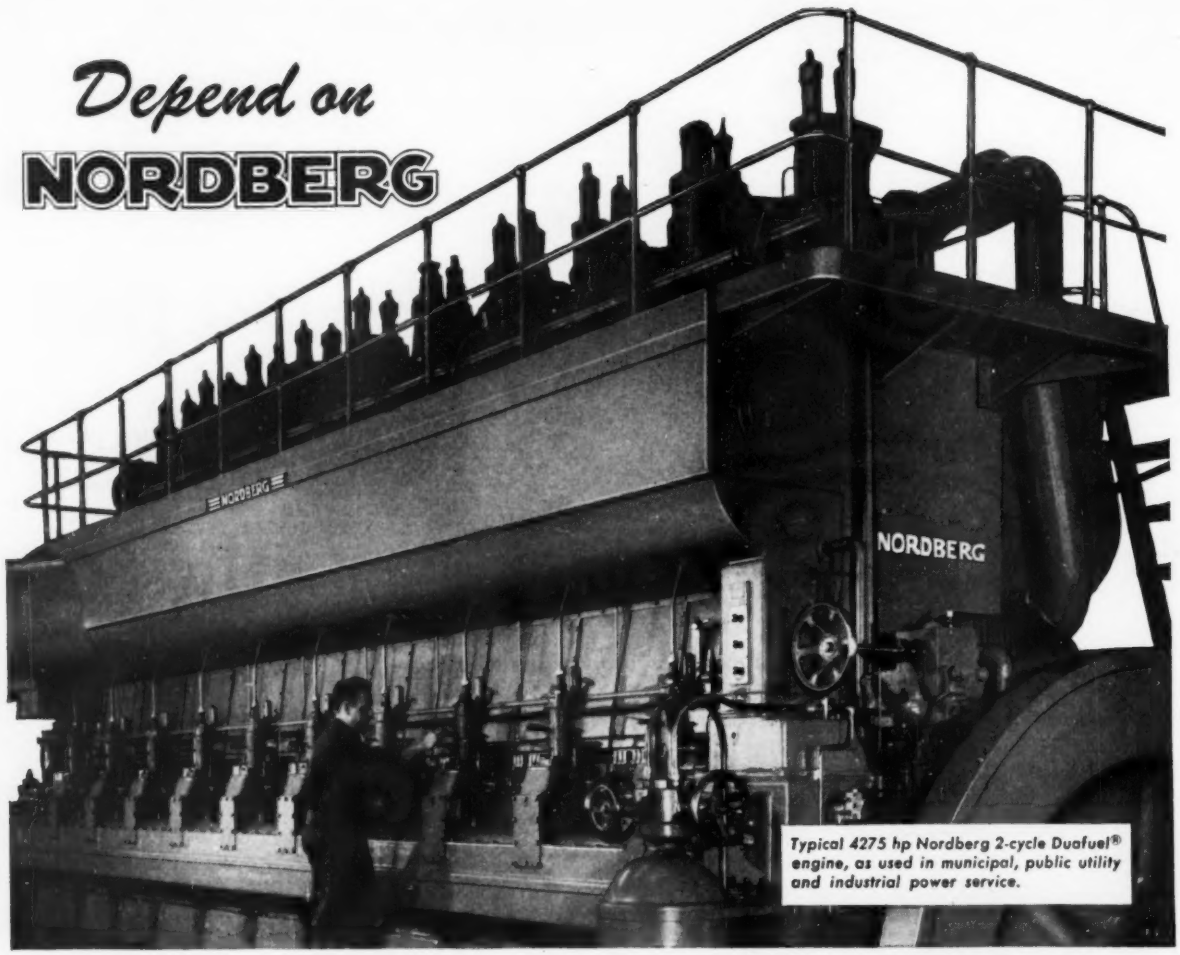
In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • *Established 1885* • 850 MORGANTOWN ROAD, READING, PENNA.

Depend on

NORDBERG



Typical 4275 hp Nordberg 2-cycle Duafuel® engine, as used in municipal, public utility and industrial power service.

for the BEST in Modern Diesel Power

Here are 6 reasons why:

1. **BUILT-IN DEPENDABILITY**
   Heavy duty construction unmatched for long life and trouble-free operation.
2. **UNEQUALLED EXPERIENCE**
   Heavy machinery builders since 1890, Nordberg produces America's largest line of heavy duty Diesels.
3. **ECONOMICAL AT ALL LOADS**
   Controlled fuel injection assures maximum fuel economy.
4. **CONTROLLED POWER**
   Instantaneous response to changing load conditions.
5. **COMPLETE ACCESSIBILITY**
   Simplicity of design and construction makes all parts readily accessible.
6. **LOW MAINTENANCE**
   Advanced engineering results in less maintenance cost per kilowatt-hour.

Nordberg Engines are now built in sizes from 10 to over 10,000 horsepower in a single engine . . . including Diesel, Duafuel® and Spark-Fired Gas Burning types.

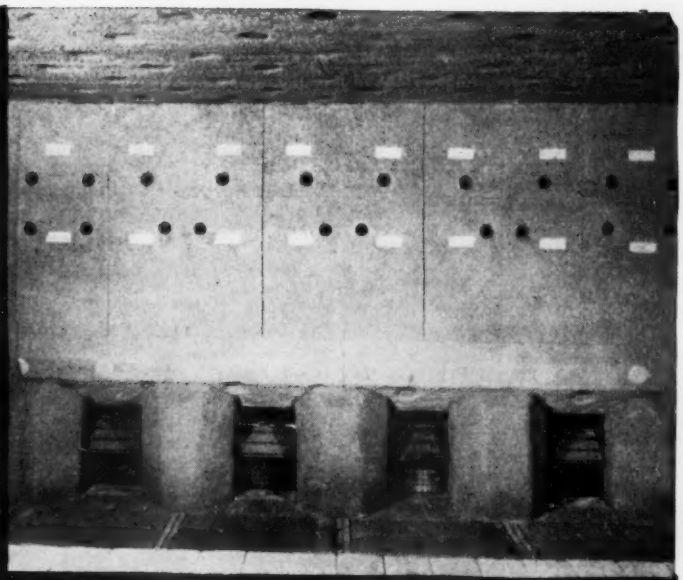
When you think of POWER—think of NORDBERG. Write for further details, outlining your power requirements.

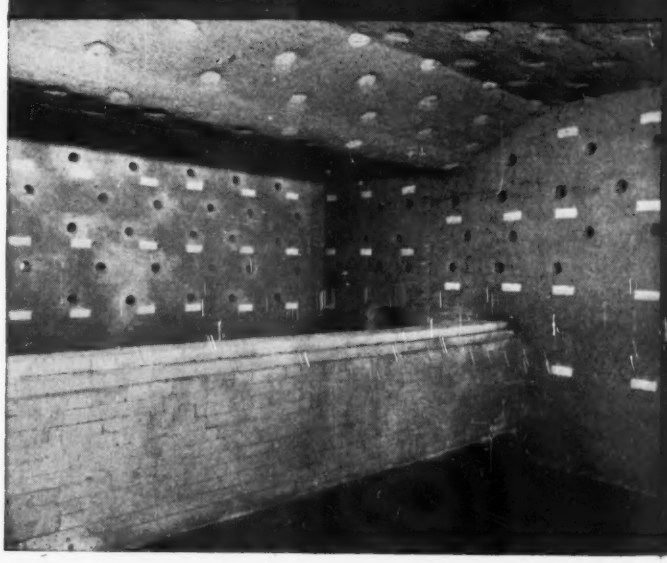
NORDBERG MFG. CO., Milwaukee, Wis.

P353

NORDBERG
DIESEL ENGINES

SPECIFY
A. P. GREEN
Plastic Firebrick Linings
FOR LONGER LIFE . . .
LOWER
MAINTENANCE COSTS

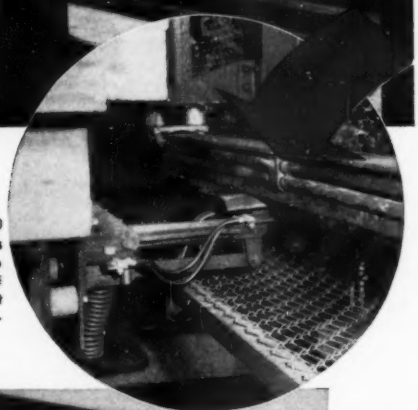




A. P. Green
REFRACTORY
PRODUCTS

CADWELD CONNECTIONS INSURE POWER

WHEN AND WHERE YOU NEED IT!

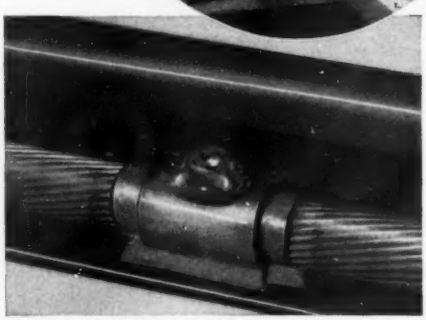


● TWO—1000 MCM power cables "CADWELDED" to an inverted 110# feeder rail. Contact shoe riding underside of rail.

NO VOLTAGE DROP when booster cables are "CADWELDED" to feeder rails on ore bridges and traveling cranes.

CONSTRUCTION AND MAINTENANCE COSTS ARE SUBSTANTIALLY REDUCED by the use of "CADWELD" as connections are made in a matter of minutes with lightweight portable equipment.

The "CADWELD PROCESS" of welding copper to steel rail is fully proved by the fact that over 10,000,000 signal bonds and thousands of propulsion bonds have been installed by the "CADWELD PROCESS"® on leading railroads.

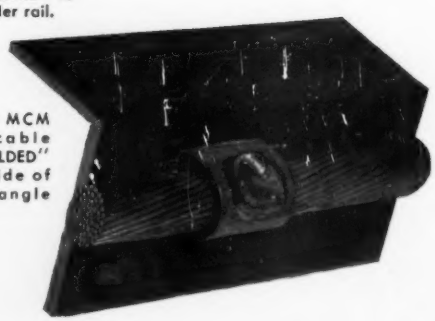


● 1000 MCM power cable "CADWELDED" to 40# feeder rail.

FOR ELECTRIFYING RESULTS

TRY **CADWELD®**

Write for Electrical Catalog today



● 1000 MCM power cable "CADWELDED" to 45° side of 4" x 4" angle iron.

ERICO PRODUCTS, Inc.

2070 E. 61st PLACE

CLEVELAND 3, OHIO

FOR

"on-the-spot" checking...

INVESTIGATE THESE WIDELY-USED TEST SETS

In appearance, the 8657-C Indicator is typical of L&N test sets and is outstanding for fully dependable, moderate precision. The portable series also includes instruments for measuring temperature, electrolytic conductivity, electrical resistance and pH.

High on any list of "musts" for making spot-checks of power production processes and equipment are these L&N Test Sets. For these versatile instruments combine the portability, ruggedness and simplicity of design needed for plant use, with the accuracy and flexibility necessary for use in the laboratory.

Specifications for just a few of these instruments that are particularly useful to the Power Industry appear below. For more complete information, contact our nearest office or write 4910 Stenton Ave., Phila., Penna.

The 7664 L&N Stabilized pH Indicator gives direct readings in pH in either grounded or ungrounded solutions. It is also used in oxidation-reduction measurements.

FOR pH AND REDOX MEASUREMENT

Instrument	List No.	Range	Limit of Error
Stabilized pH Indicator — for direct reading in pH; also for oxidation-reduction measurements. May be used in grounded or ungrounded solutions. For operation on 115 volts, 60 or 50 cycles.	7664	0 to 14 pH; 0.1 pH divisions 0 to ± 700 mv; d-c; 5 mv divisions 0 to ±1400 mv; d-c; 10 mv divisions	1 scale division

FOR THERMOCOUPLE EMF MEASUREMENT

Double-Range Portable Millivolt Indicator. For thermocouple voltage measurements — reads in millivolts; manual reference junction compensation.	8657-C	Ranges: 0 to 16 mv and 16 to 64 mv. Reference Junction Compensator Ranges: 0 to 1 mv and 0 to 5 mv.	Low Range: ±0.05 mv. High Range: ±0.15 mv.
Double-Range Portable Millivolt Indicator. A more precise instrument for uses similar to 8657-C.	8662	Ranges: 15 x 1 mv +1.1 mv slidewire 15 x 5 mv +5.5 mv slidewire Reference Junction Compensator Ranges: 0 to 1 and 0 to 5 mv.	Low Range: ±0.01 mv. High Range: ±0.05 mv.

FOR ELECTROLYTIC CONDUCTIVITY MEASUREMENT

Portable Electrolytic Resistance Indicator For measuring resistance of electrolytic solutions. Operates at 115 volts, 60 cycles.	4960	0.3 to 30,000 Ω	±1%
Portable Conductivity-Resistivity Indicator. For general use in measuring the specific conductance and specific resistance of electrolytic solutions. Operates at 115 volts, 60 cycles.	4866	Specific Conductance: 0.012 to 0.000,0001 mho per centimeter cube. Specific Resistance: 80 to 10,000,000 Ω per centimeter cube.	±0.3%

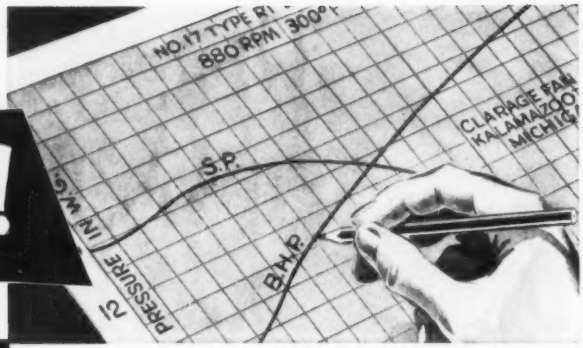
FOR RESISTANCE MEASUREMENT

Type S-1 Portable Wheatstone Bridge. For ordinary resistance testing and for locating faults in communication circuits.	5300	Useful range: 1 to 50,000 ohms direct measurement. Will measure approximate resistance at lower and higher values; also has provision for making Murray and Varley loop tests.	±.15%

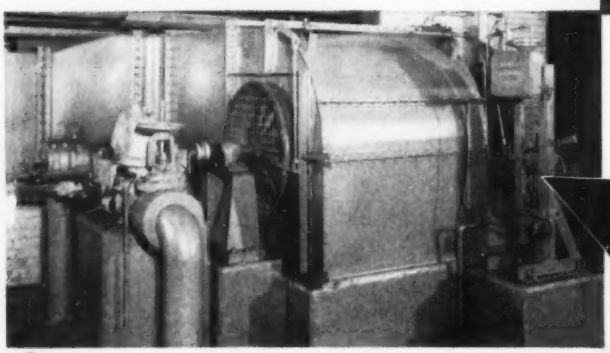
LEEDS & NORTHRUP

instruments — *automatic controls • furnaces*

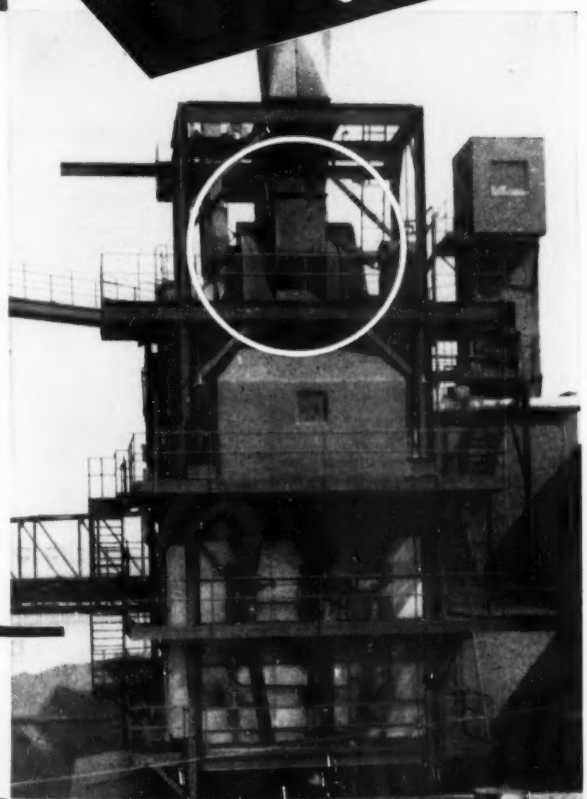
Journal Ad. No. E-0600(1c)



figured right!



built right!



The most exacting service a fan gets into is mechanical draft.

If the fan is too small, you may lack capacity for peak loads . . . too large, and you may have wasted money and space . . . inferior construction, and, well, that's real trouble.

We are specialists with long experience in meeting mechanical draft problems.

You can have faith in a Clarage recommendation — faith that your job is figured RIGHT for the required performance — faith that the equipment is built RIGHT to operate year after year with minimum attention and care.

Boiler and stoker manufacturers have a high regard for Clarage engineering and construction. Ask anyone of them, or write us for detailed information.

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

Over 3000 Public Utilities and Industrial Power Plants Use Clarage Mechanical Draft Fans

You can Rely on...

CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

More and More Leading Engineers are Now Recommending

UNIBESTOS®

PIPE INSULATION

WITH ITS SUPERIOR STRUCTURAL VALUES

(For 3¢ you can get the whole story)

UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. C-4, 332 SOUTH MICHIGAN AVENUE, CHICAGO 4, ILLINOIS

UNION ASBESTOS & RUBBER CO.
Ad No. 4463
Oil & Gas Journal, April 13, 1953
Petroleum Processing, April 1953
Power, May 1953
Prepared by
WM. HART ADLER, INC.

You're Always on the Safe Side

WHEN YOU SPECIFY

ASHCROFT Maxisafe DURAGAUGES

Here is the gauge that provides absolute protection to the viewer from tube rupture due to any cause.

In this new Ashcroft Maxisafe* Duragauge, an integrally cast solid wall separates the dial from the Bourdon tube and movement. The entire back of the case is covered by a double spring-mounted safety release plate. Teflon coated and tightly fitted on a rubber gasket, the plate is held in place by a knurled knob. If the tube ruptures, pressure less than ½ p.s.i. will force the plate open and vent the discharge to the rear.

Always be on the safe side. Get absolute protection against the possibility of tube rupture — specify the Ashcroft *Maxisafe* Duragauge. The *Maxisafe* has all the long-life durability and precision accuracy of standard Ashcroft Duragauges. It's available in all Duragauge pressure ranges, Bourdon tube materials, case designs (except Types 1179 and 1279), and mountings, in 4½, 6 and 8½ inch dial sizes. Ask for details in selecting *Maxisafe* Duragauges. Phone your local Ashcroft Gauge Distributor.

*Reg.

NOTE THE SOLID WALL

that separates the dial from the Bourdon Tube and movement. Three ¾" lugs on the back flange hold the *Maxisafe* away from the wall and permit the safety plate to release. *The case design also provides easy, quick access to the movement and tube assembly for inspection, repair or recalibration.*

FOR FAST DELIVERY — buy from your Industrial Distributor. He stocks Manning, Maxwell & Moore products locally — saves you the trouble and expense of maintaining a large inventory in your own plant.

ASHCROFT GAUGES

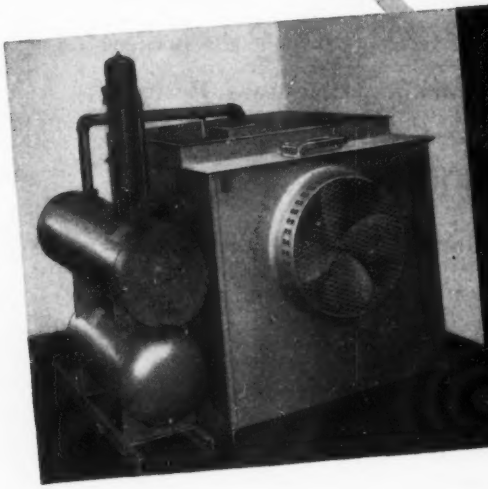
A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'ASHCROFT' GAUGES, 'HANCOCK' VALVES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

New

SAVES WATER and CUTS MAINTENANCE COSTS . . .

Illustrations show two views of a 35 ton Condenser Tower prior to partial disassembly for shipment.



Vogt

CONDENSER TOWER

FOR CONDENSING REFRIGERANTS

SINGLE RESPONSIBILITY:

Vogt, leading builder of refrigeration condensers, assumes responsibility for engineering the unit. Only one purchase order needed.

SHOP FITTED:

To cut down field assembly labor. Requires no cutting or fitting of pipe.

Designed for today's water conservation requirements, and to keep refrigeration costs low, the *new* Vogt Condenser Tower meets the need for a proven, readily cleanable condensing unit.

The Vogt Condenser Tower consists of a multipass straight tube condenser, a receiver, an oil trap, a cooling tower, and a water pump. Removable cast iron heads permit easy cleaning of the condenser tubes.

Water costs are extremely low since the cooling water is recirculated continuously and requires only a small amount of makeup to replace losses due to windage and evaporation.

Condenser Tower units are available in capacities ranging from 5 to 50 tons refrigeration. Additional information will be furnished upon request.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W VA

3 for *Power*'s

All of these departments are of important and lasting usefulness to power engineers

MODERN PLANT SURVEY

Twenty-four pages with tabulated technical details on five hundred new steam and hydro plants. Capacity, design trends, major equipment. Includes data on plants newly completed, in construction, and planned.

THE RENOVATION ROUNDUP

200 ideas for saving money and improving efficiency in power system modernization.

DIRECTORY OF POWER-FIELD MANUFACTURERS

The only directory of power-field equipment and who makes it. Over six hundred product listings with names and addresses of more than one thousand manufacturers.

CROSS FILE OF OBSOLESCENCE

Names of former manufacturers of power-field equipment, matched with name of successor company. Especially useful in any general campaign of modernization where obsolete equipment is being replaced or renewed.

THE SHOW CASE

Devoted to many of the new products which will be needed to modernize power-systems. Name of manufacturer in every case. A double order card in the issue will make it easy for readers to get additional information.

Since POWER's Modern Plant Handbook was announced in the February issue, we've received many letters praising the project and making suggestions. Here are just 3 from those who happened to be the first to applaud.

Do you have plant modernization problems? Glance at the contents of the Handbook issue, listed at the left. There's still time to give us your ideas, and we will welcome them.

Watch for

THE MODERN

to be

IT WILL BE

CHEERS!

MODERN PLANT HANDBOOK ISSUE

1 "--your plans to publish The Modern Plant Handbook are worthwhile and timely. Most of our renovating plans for the near future involve the installation of new control instruments. Specific information on the cash value of an enlightened instrumentation program would be appreciated."

W. P. Bramlett, Jr., Plant Engr.
Armstrong Cork Co., Millville, N. J.

2 "--anything that will help the engineer to meet rising costs, particularly of buildings and equipment should prove timely. The engineer has done much to "cushion" the inflationary costs of labor -- inflationary in cost per hour, but worse still, inflationary in that men produce less unless better tools are provided them."

J. B. Sims, Superintendent
Board of Public Works
Grand Haven, Michigan

3 "I like your idea of the Cross-file of Obsolescence. We have found checking old equipment for replacement parts or complete replacement a time-consuming task in both the power and textile machinery fields. We will look forward to your publication hoping to gain information on boiler feed water and condensate return water. These items are to us most important in keeping up our power plant efficiency. Business conditions in the textile field have been a little rough, requiring us to keep up efficiency with a minimum expenditure of money."

T. W. E. Bowdler, Chief Engineer
Botany Mills, Inc., Passaic, N. J.

PLANT HANDBOOK ISSUE

published September 15, 1953

DISTRIBUTED TO ALL REGULAR **Power** SUBSCRIBERS

How ONE can equal SIX

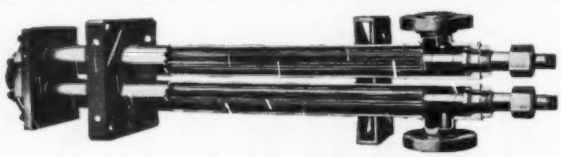
IN FUEL OIL HEATING

Conventional fuel oil heaters have bare tubes, with practically the same amount of surface inside and outside. But fuel oil requires more heat transfer surface than does the heating steam, because of its considerably lower heat transfer rate. Therefore, the number of bare tubes required for the heat-absorbing capacity of the oil is very much greater than the number which would be sufficient for the heat conductivity of the steam.

The G-Fin heat transfer elements of the G-R Twin G-Fin Section compensate for this difference in heat transfer rates of oil and steam. Their longitudinal fins have a total of more than 6 times as much surface as the interior of the elements. This means that a Twin G-Fin Section will have only 1/6 the number of tubes that would be required by a conventional bare tube heater for the same duty.

Investigate these compact, simple units and their many other advantages for heating your fuel oil. Complete information will be sent without obligation.

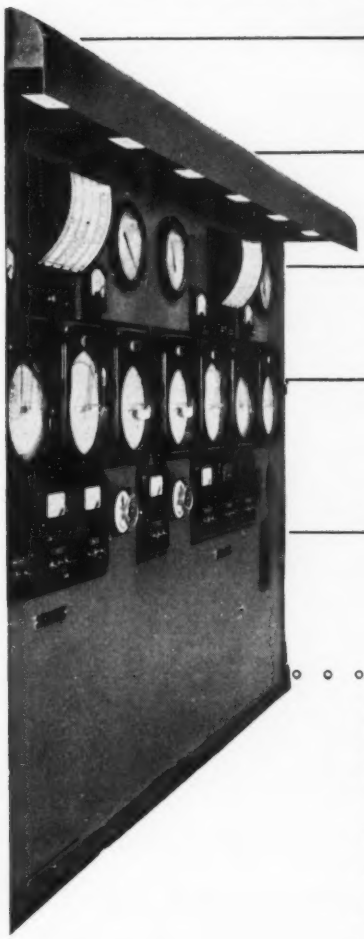
THE GRISCOM-RUSSELL CO., MASSILLON, OHIO



G-R HEAT TRANSFER APPARATUS *Twin G-Fin Section*

what *results* do you want from your

COMBUSTION CONTROL SYSTEM ?



Low maintenance?
"We find that due to the (Hays) properly controlled combustion, our maintenance on both stokers and boilers has been considerably decreased."
American Tobacco Company

Good CO_2?
"CO_2 readings show that on an average day our CO_2 varies between 13% and 14% despite load fluctuations."
Sunshine Biscuits, Inc.

Increased efficiency?
"Operating efficiency has been as high as 82%—much of the credit going to the accuracy of (Hays) automatically controlled combustion."
Sherwin Williams, Chicago Plant

Fuel savings?
"We estimated that . . . we would be able to pay for the new equipment (Hays Combustion Control) out of fuel savings in three years. Since then, the records show that the amortization of the original investment has been accelerated."
Raybestos—Manhattan, Inc.

Rapid response to wide load swings?
"We have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs per hour with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%."
Bemis Brothers Bag Company

You want the *specific results to solve your combustion problems.* Hays engineers have the experience to give you results like:—

- **smoke abatement**
- **reduced labor costs**
- **decreased outage**
- **constant steam pressure**
- **lower fuel bills by switching fuels**
- **firing mixed fuels efficiently**
- **rapid response to steam demand**

HOW TO GET *RESULTS*

Send a statement of your combustion problem and the results you want to Orval W. Riggs, Mgr., Application Engineering, The Hays Corporation, Michigan City 3, Ind. You will receive: 1. Our preliminary recommendations for a solution to *your* problem. 2. Hays' 48-page booklet on control systems and how they work. 3. Five "Case Histories", telling how leading companies got "results" on five different problems with

HAYS COMBUSTION CONTROL

THE **HAYS** CORPORATION *MICHIGAN CITY 3, INDIANA* • Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters • Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages • Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

This water clarifier plant is really COMPACT

No plant executive or engineer wants to use more space or install costlier equipment than necessary to serve a desired purpose.

Here is an example of how both space and money can be conserved in *water clarification.*

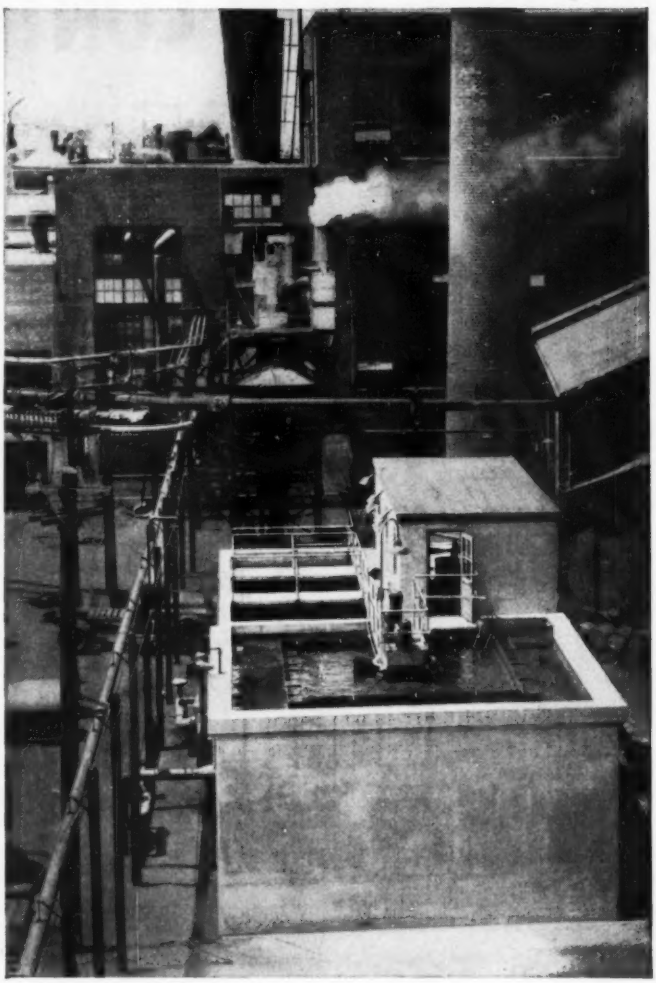
This Graver Reactivator, occupying only 23 feet square, and installed in a concrete outer shell, together with Graver Gravity Filters and Chemical Feeder, is purifying water at the rate of over 860,000 gallons per day.

The installation is handling a highly contaminated raw water supply which is extremely variable in characteristics. The turbidity varies from 20 to 200 ppm, and the B.O.D. (biological oxygen demand) ranges between 30 and 200 ppm.

In spite of these difficult conditions, this compact, efficient unit produces an effluent that consistently contains less than 5 ppm turbidity.

In addition, the operating cost is extremely low, and only negligible attention by unskilled personnel is required.

To make *your* polluted, turbid or hard raw water suitable for process work, boiler feed or general service in least space at lowest cost, investigate the Graver Reactivator. Complete information sent without obligation.



GRAVER WATER CONDITIONING CO.
Division of Graver Tank & Mfg. Co., Inc.
DEPT. P-R, 216 WEST 14TH STREET, NEW YORK 11, N. Y.
In Canada: The Bird-Archer Co., Ltd.; Cobourg, Ontario
In Mexico: Proveedores Tecnicos, S.A.; Puebla 259, Mexico 7, D. F.

GRAVER Reactivator

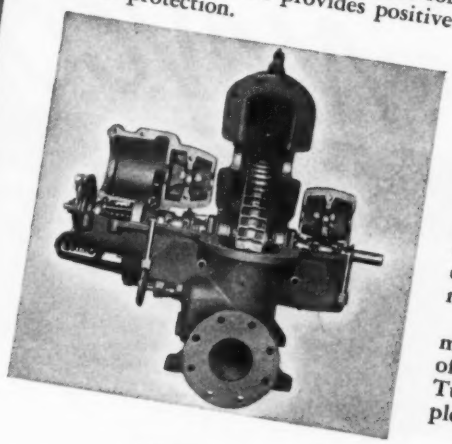
GW 471

TERRY

PROTECTION OF TURBINE BLADES made possible by nozzle location

The Terry Solid-wheel Turbine is of the impulse, helical flow type. The steam issues from an expanding nozzle at high velocity and enters the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is returned to the wheel several times until practically all of the energy has been utilized. This principle makes possible the efficient use of steam in a single-piece, almost indestructible wheel.

In the Terry Solid-wheel Turbine, the steam enters the buckets in a direction at right angles to the shaft, as shown above. This design eliminates the need for close clearances and provides positive blade protection.



The blades cannot foul. There is a one inch clearance on either side of the wheel. In addition, projecting rims on each side of the buckets prevent damage to the blades even though external thrust should move the wheel.

This is only one of the many important features of the Terry Solid-wheel Turbine. Write for complete details.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1195

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

No job is too unusual for NAVCO

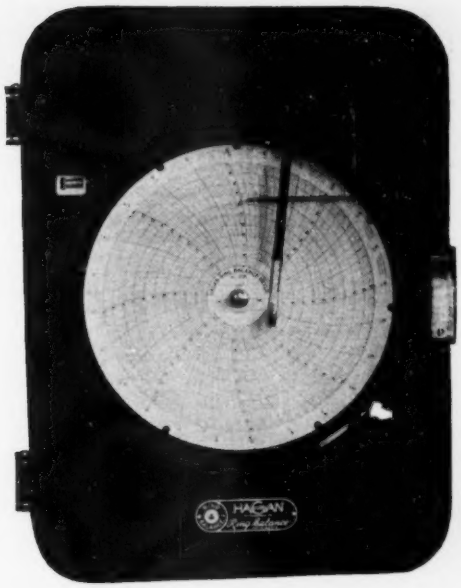
NAVCO

Whether you require a simple pipe bend or a complicated prefabricated assembly Navco can help you. As shown above, Navco Shops are equipped to handle Chrome Moly, Stainless, Carbon Steel and Copper, in addition to any of the many other Ferrous and Non-Ferrous materials.

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • BUFFALO • CINCINNATI



When you install

HAGAN RING BALANCE FLOW METERS

You install

Accuracy

Dependability

Durability

Versatility

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING LABORATORIES

Hagan Ring Balance Flow Meters give dependable readings over the chart range, and give good response at low flow rates.

The calibration may be checked under full static pressure conditions by a simple check-weight method. One man can check calibration in a few minutes.

The simplicity of design, coupled with sturdy construction, assure long meter life and low maintenance costs.

The Hagan Ring Balance Meter is the most versatile meter made. Whatever your metering problems, our engineers will be glad to show you how Hagan Meters can help you solve them.

HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PA.

Hagan Corporation
Hagan Building
Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters.
I am particularly interested in_____

NAME_____

POSITION_____

COMPANY_____

STREET AND NUMBER_____

CITY_____ ZONE____ STATE_____

P-4

PENBERTHY *Jet Pumps*

(EJECTORS • EDUCTORS • EXHAUSTERS • SYPHONS)

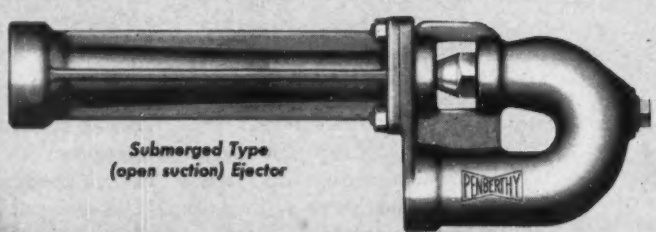
Often the MOST ECONOMICAL and EFFICIENT WAY to Transfer and Mix Fluids

The jet pump is a simple device which uses steam, water or air under pressure to pump (or mix) fluids that can include solids in suspension. Jet pumps have no moving parts, need no lubrication, have no packing glands, are practically noiseless. They are low in initial cost and installation cost . . . compact in size and trouble-free. Penberthy offers a variety of jet pumps for a wide range of ordinary and unusual applications. They can be made from materials that withstand corrosion, contamination and high temperatures. Ask for new Bulletin 512.

Standard Ejector for Steam or Air Operation

Standard Hydraulic Ejector

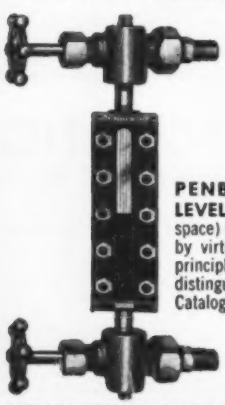
Stainless Steel Jet Pump for Handling Corrosive Chemicals



Submerged Type (open suction) Ejector

WRITE FOR *New* BULLETIN No. 512

OTHER PENBERTHY PRODUCTS



PENBERTHY TRANSPARENT LIQUID LEVEL GAGE—Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal. Ask for Catalog 35.

PENBERTHY REFLEX LIQUID LEVEL GAGE—Empty space (or steam space) shows white and liquid shows black by virtue of a simple, unvariable optical principle. Accurate reading as far as you can distinguish black and white. Write for Catalog 35.

PENBERTHY AUTOMATIC INJECTOR—Will supply feed water to boiler at minimum cost. Quickly, easily installed, reliable under most severe operating conditions. Ask for Bulletin 513.

4731

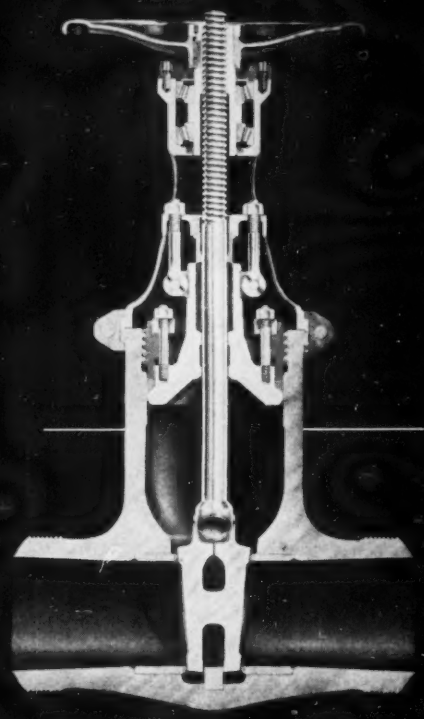
PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

Detroit 2, Michigan

Established 1886

Canadian Plant—Windsor, Ontario



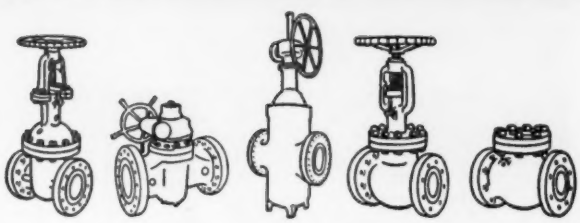
STEEL

COMPLETE LINES OF CAST STEEL VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of pressure classes, types, sizes, and patterns for general industrial use. Walworth also manufactures cast steel valves for specific service applications.

Walworth produces steel bar stock valves, and cast steel valves made of carbon steel, carbon molybdenum steel, corrosion-resistant, and heat-resistant alloy steels. Included are gate, globe, angle, check, and lubricated plug types. Sizes range from ⅛ to 30 inches; pressures range up to 5,000 psi. Full information is contained in Walworth General Catalog 52, a copy of which will be forwarded if requested on business letterhead.

Walworth also manufactures complete lines of valves and fittings made of bronze, iron, and special alloys as well as steel. Walworth-made valves, fittings, and pipe wrenches total approximately 50,000 items.

Walworth engineers will be glad to help you with your problems. For full information, call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Illustrated in section is an 8-inch Series 900, Walworth Pressure-Seal Cast Steel Gate Valve designed for high-pressure, high-temperature service. Pressure-Seal Valves are available in Series 600, 900, 1500 and 2500; sizes 1 to 16 inches. Small Cast Steel Valves, Series 1500, in angle and Y-globe types, are also available in sizes ranging from ¼ to 2 inches.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

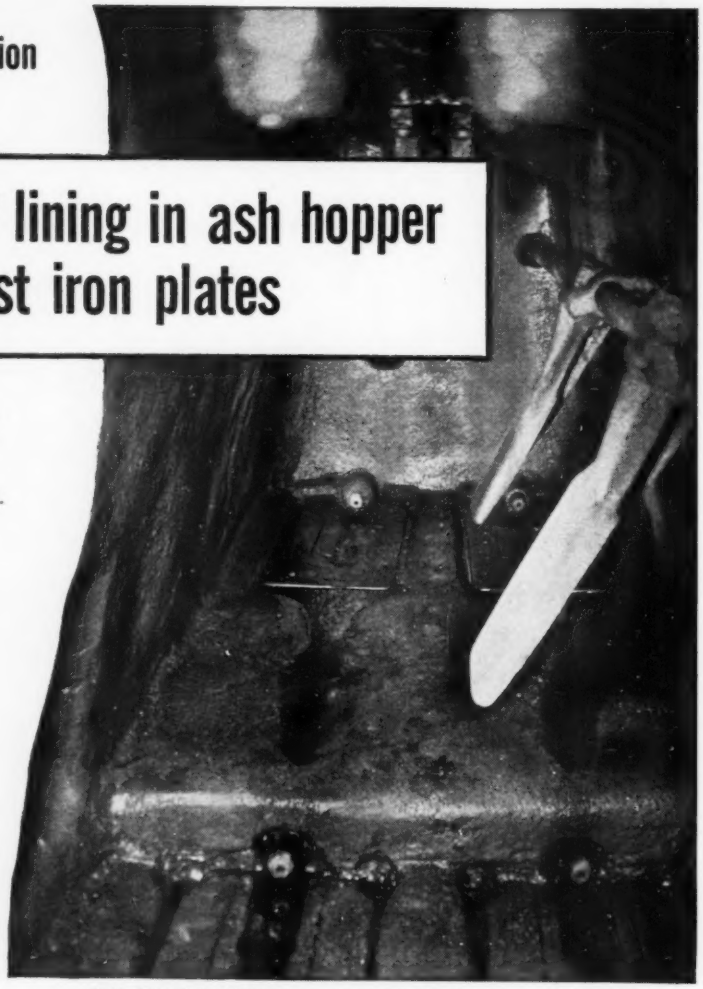
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Westinghouse Electric Corporation finds that . . .

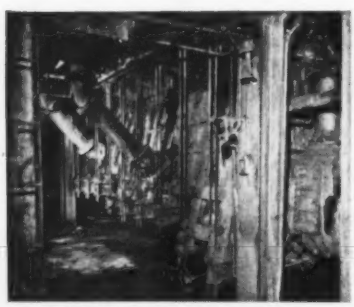
Low-cost LUMNITE* lining in ash hopper outlasts cast iron plates

Instead of replacing cast iron plates on this ash hopper, Westinghouse engineers simply specified a 2" lining of Heat and Corrosion-Resistant Concrete made with Lumnite cement. They've found it does a job fast . . . costs *far less* than new plates . . . and lasts much longer. In fact, they're so well pleased with Lumnite they now use it to line all their ash hoppers.

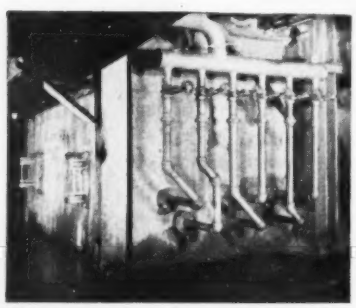
Does their experience with Lumnite cement suggest profitable uses to you? It's proved to be a better way to line stacks, breechings and flues . . . make coal bunkers, ash pits . . . cast door linings, water wall studding and baffles, and make many fast repairs. Concrete made with Lumnite calcium-aluminate cement reaches service strength within 24 hours. With appropriate aggregate it withstands heat of 2600°F. or more, and it's highly resistant to abrasion, corrosion and thermal shock.



THIS GIANT ASH HOPPER at the East Pittsburgh, Pa., power plant of Westinghouse got its durable lining of Lumnite concrete in a hurry. Lining was simply shot on with a cement gun.



CAST IRON PLATES on this ash pit were a major maintenance item—until Westinghouse used Lumnite concrete linings as in top photo.



LININGS made with Lumnite proved so successful, Westinghouse engineers specified Lumnite for this all-concrete ash hopper at the Trafford, Pa., Power Plant.

FOR CONVENIENCE in making Refractory and Insulating Concrete, you may prefer to buy prepared Castables. These packaged mixtures of Lumnite and selected aggregates are tailor-made to meet your specific temperature and *insulation* requirements. Add only water. They are made by refractory manufacturers and sold through their dealers.

For complimentary booklet on the many uses of time- and-money-saving Lumnite write: Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

*"*LUMNITE*" *is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

P-L-64-B

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

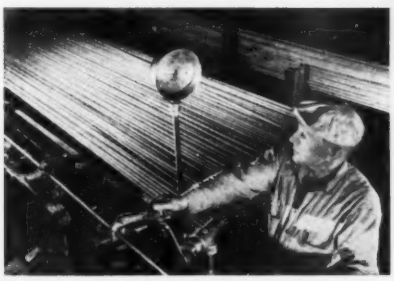
REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

Chase Antimonial Admiralty

(a patented alloy)



Every Chase Antimonial Admirally condenser tube is tested to withstand at least 1,000 pounds per square inch water pressure.

Meets every test for Condenser Tubes

Chase flattening test, index of Antimonial Admiralty tube's physical quality and ability to withstand bending or end flaring.

This Chase metallurgist is checking the size and uniformity of grain of Chase Antimonial Admiralty condenser tubes.

When you put Chase Antimonial Admiralty* tubes into a condenser you *know* they'll stand up for years. It isn't only that we make certain there's enough antimony to resist dezincification. Chase condenser tubes are carefully tested and retested for *every* physical and chemical property required to meet actual field conditions. It pays to insist on Chase Antimonial Admiralty.

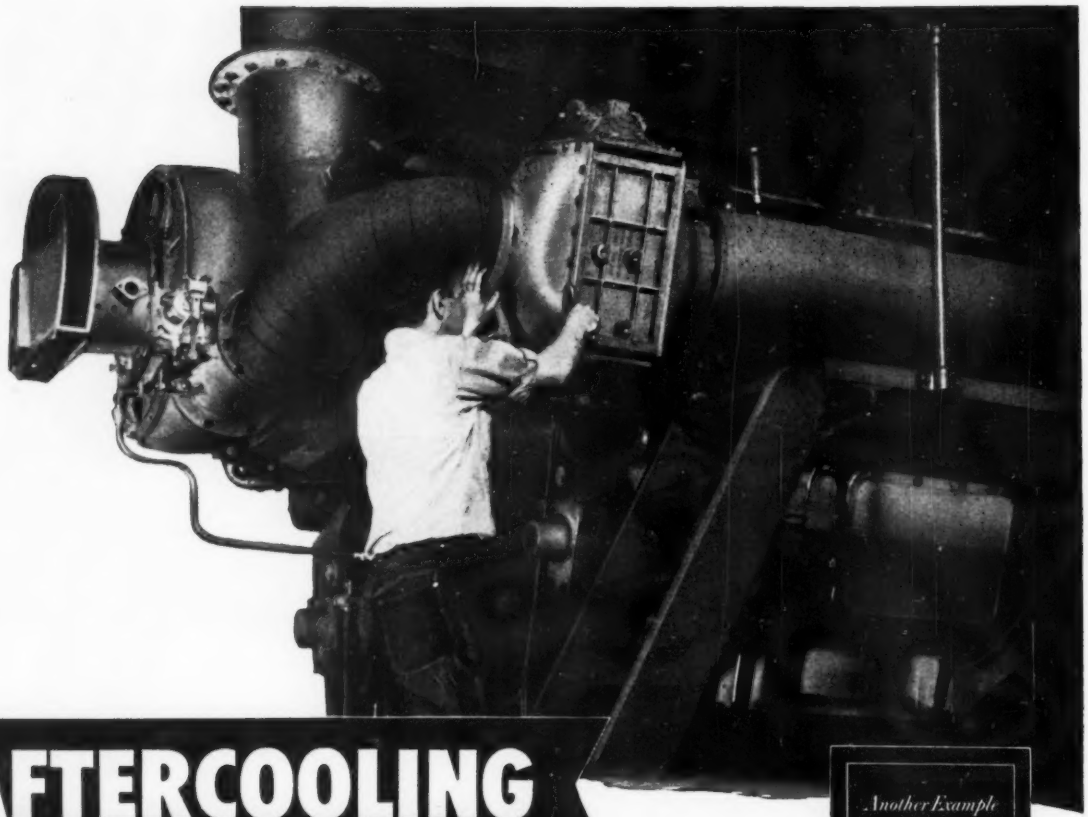
*U. S. Pat. No. 2,061,921

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany †	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver †	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston †	Newark	Rochester †	(† sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)



AFTERCOOLING

Another Example of Efficient Power at Lower Cost

a dividend in extra power for users of Cooper-Bessemer supercharged diesels

• Yes, if you are operating a supercharged Cooper-Bessemer diesel, you're in line for Cooper-Bessemer aftercooling — a sure-fire way to increase your horsepower approximately 15%.

It involves only a simple, surprisingly inexpensive modification. No change in engine speed, space requirements, jacket water cooling system or overload capacity. The aftercooler is readily inserted between the supercharger and intake manifold. Here the combustion air is watercooled, resulting in greater power and higher combustion efficiency.

If you can use additional power to advantage, here's a simple, inexpensive way to get it — another typical example of progressive engineering at Cooper-Bessemer. Why not talk it over with our nearest office?

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

GARLOCK BITAN Leather Cups, Packings and Gaskets

GARLOCK CHEVRON Hydraulic Packings

GARLOCK GUARDIAN Asbestos-metallic Gasket

GARLOCK KLOZURE Oil and Grease Seals for Bearings

GARLOCK LATTICE-BRAID Rod and Shaft Packings

BITAN*
CHEVRON*
GUARDIAN*
KLOZURE*
LATTICE-BRAID*

These familiar brand names are registered trade-marks belonging to The Garlock Packing Company. They are never to be used as generic terms to designate types of products and are properly used only to denote products manufactured by Garlock.

*Trade-Mark Reg. U.S. Pat. Off.

BITAN Leather Packings, CHEVRON Packings, GUARDIAN Gaskets, KLOZURE Oil Seals and LATTICE-BRAID Packings are all exclusive products of Garlock's own factories. So, wherever you see these trade-marks you can be sure that the products with which they are used are of proper design and are manufactured to the highest quality standards. They will give you long, dependable service.

Branch Offices in Principal Cities
THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK®

PACKINGS, GASKETS, OIL SEALS, MECHANICAL SEALS, RUBBER EXPANSION JOINTS

WHAT MUST YOU HAVE

... IN POWER PIPING?

Above all other things, you must have CONFIDENCE in it.

Confidence can't be purchased—it is acquired only through complete belief in the pipe fabricator's skill, facilities, technical knowledge . . . and *experience.*

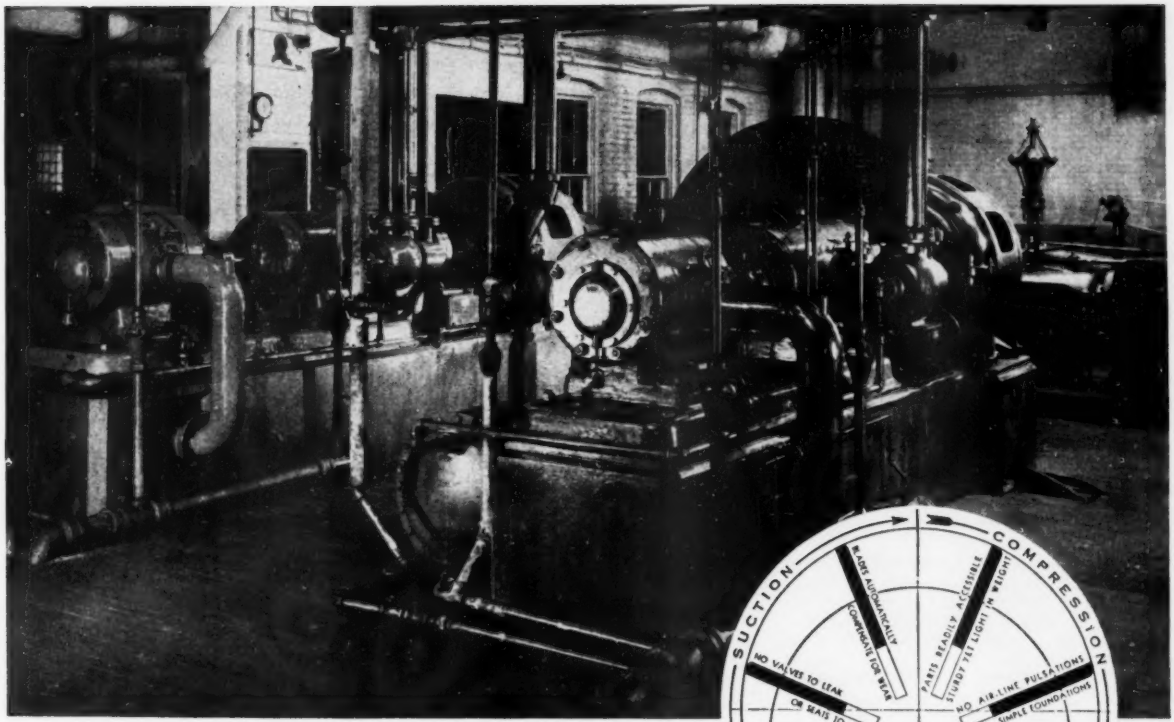
P. P. & E. has been fabricating all types of high-pressure, high-temperature piping for central stations, paper mills, process and industrial plants for almost half a century. The importance of this experience, to you, is its great value in avoiding errors of omission and commission which can result in inefficiency, damage to expensive equipment, and dangerous operating conditions.

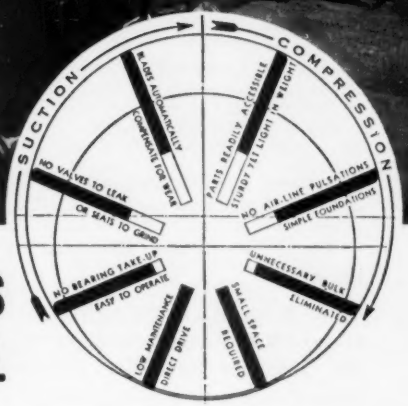
When P. P. & E. does the job, utmost care is taken to evaluate and interpret specifications correctly, and to comply strictly with code and insurance company requirements. Highly specialized shop facilities for bending, welding, Van Stoning, machining, heat-treating, testing, and inspection have been developed, and are operated by skilled workmen under competent supervision. A trained field organization directs the installation of complete systems, extensions, or alterations to existing layouts in any part of the country.

OFFICES IN OTHER CITIES:

Atlanta.....Whitehead Building	Houston..Heights State Bank Bldg
Boston.....10 High Street	New Orleans.....P. O. Box 74
Chicago....Peoples Gas Building	New York...Woolworth Building
Cleveland..Public Square Building	San Francisco..785 Market Street

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.





FULLER ROTARY AIR COMPRESSORS ... WORK FOR SCOVILL

Long periods of continuous operation don't overtax these Fuller Rotary Compressors at Oakville Company Division, Scovill Manufacturing Company plant at Oakville, Connecticut, where two 850 c.f.m. two-stage compressors supply plant needs at 80-lb. pressure.

Endurance, plus maintained efficiency, are results of the rotary principle employed in these compressors. Elimination of reciprocating parts does away with flow pulsations, cuts down on vibration and need for take-up of bearings. Another feature of interest to cost-conscious engineers is the limited maintenance required by Fuller Rotary Compressors—rotor, blades, and bearings are the only moving parts.

Because these compressors do not require valves, top overall efficiency is maintained at all times—no capacity is lost around leaking valves, no time lost to grind seats. Fuller compressors are designed to operate at common electric motor and internal-combustion engine speeds.

You'll find these compressors stay on the job, operate with sustained high efficiency and require little maintenance. If your plant requires air in volume, it will pay you to investigate the advantages of Fuller Rotary Compressors. A Fuller engineer will be glad to discuss them with you.

Fuller

FULLER COMPANY, Catasauqua, Pa.

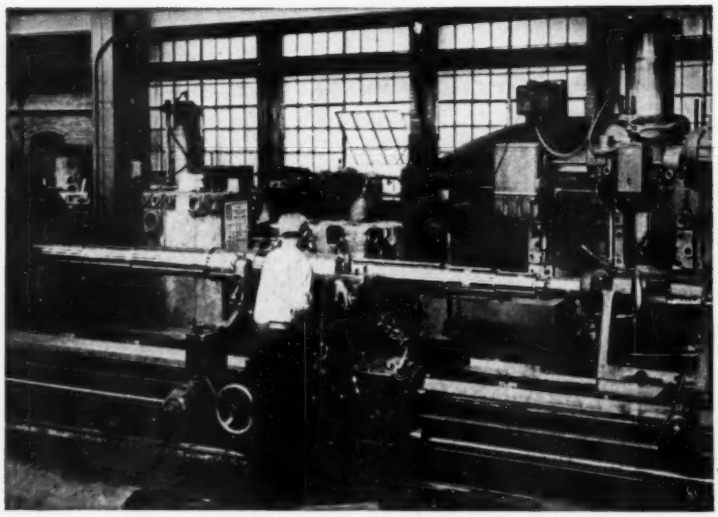
Branch offices

Chicago—San Francisco—Los Angeles—Seattle—Birmingham

C-223
1863

PIONEERS OF HIGH-EFFICIENCY VANE-TYPE ROTARY COMPRESSORS

When you need a tough, fatigue- and corrosion-resisting alloy —try "K" Monel



This is the largest INCO Nickel Alloy pump shaft in the world. The shaft is 13 feet 7⅛ inches long, 9.005 inches at its widest diameter, and weighs 3,343 lbs. It was forged by INCO'S Huntington Mill from "K" Monel for Consolidated Edison Co., after other materials repeatedly failed.

Are there applications in your operation where metal is subject to fatigue, corrosion and erosion?

Then chances are "K" Monel is the alloy you need.

"K" Monel is a tough, corrosion-resisting wrought alloy of Nickel, copper and aluminum. It offers you the excellent corrosion resistance of regular Monel, together with the added advantages of greater stiffness and hardness through heat treating.

As evidence of the value of "K" Monel's added advantages, take a pump shaft operating in highly corrosive and polluted salt water.

New York City's Consolidated Edison Company has two big 80,000-gallon-per-minute condenser circulating water pumps. For years engineers kept replacing the shafts with materials of increasing strength but failures would continue to occur in the same spot because of corrosion fatigue.

Finally, they decided to try "K" Monel.

A 1½-ton heat-treated "K" Monel shaft with a tensile strength of 140,000 pounds per square inch was installed in September of 1949 and has been functioning perfectly ever since. In fact, the pump casing has not even been opened for inspection since installation.

Let's take a quick look at a few of the principal characteristics of "K" Monel:

Age-hardenable, or capable of having its hardness and mechanical properties increased simultaneously as the result of thermal treatment, "K" Monel is equal in strength and toughness to many heat-treated alloy steels. It shows improved strength and hardness at sub-zero temperatures with no loss of toughness. And it provides moderate strength at temperatures up to 900° F.

"K" Monel is non-magnetic under ordinary conditions, and remains so down to −150° F.

The working characteristics of "K" Monel are excellent, too. It is readily machined in an annealed condition, but in other conditions may be considered commercially machinable at practical (although generally somewhat slower) rates. It can be joined by the usual welding, brazing and soldering processes.

You'll find all essential engineering data on "K" Monel and its more machinable companion alloy, "KR" Monel, in the 24-page reference manual, "Engineering Properties of 'K' Monel and 'KR' Monel." Write for your copy.

At present, INCO Nickel Alloys are in great demand for defense purposes. It pays to anticipate your equipment needs as far in advance as you can, and then place your orders with suppliers at once.

The International Nickel Company, Inc.

67 Wall Street, New York 5, N. Y.

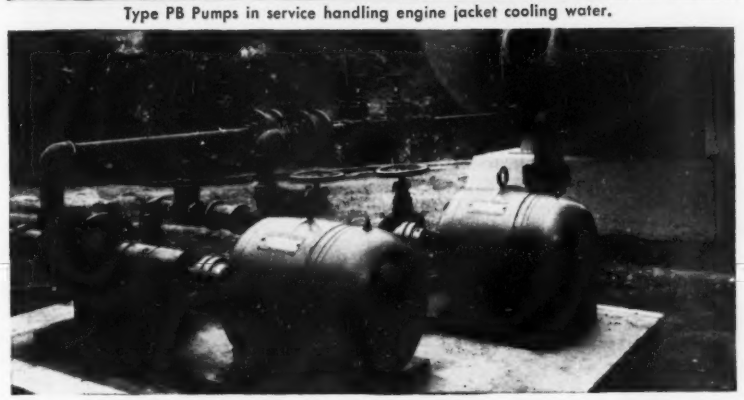
Nickel (INCO TRADE MARK) Alloys

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • NICKEL • LOW CARBON NICKEL • DURANICKEL® • INCONEL®
INCONEL "X"® • INCONEL "W"® • INCOLOY® • NIMONICS®

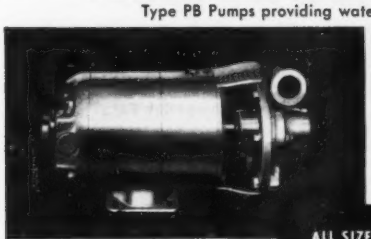
BIG OR SMALL — INDOORS OR OUT YOU CAN SAVE ON COST AND SERVICE WITH PEERLESS *FLUIDYNE* PUMPS

PEERLESS PUMPS

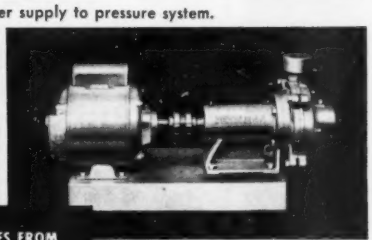
Type PB Pumps in service handling engine jacket cooling water.



Type PB Pumps providing water supply to pressure system.

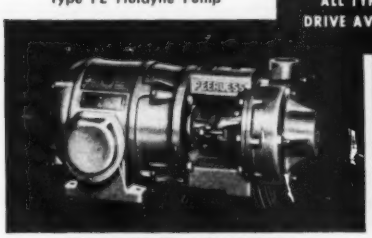


Fractional HP Close Coupled Electric Type PE Fluidyne Pump

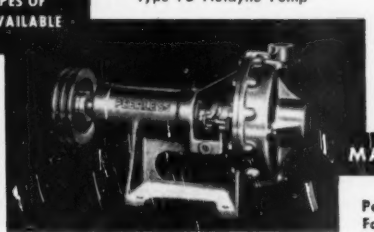


Fractional HP Flexible Coupled Type PB Fluidyne Pump

ALL SIZES FROM ¼ H.P. to 150 H.P. ALL TYPES OF DRIVE AVAILABLE



Integral HP Close Coupled Electric Type PE Fluidyne Pump



Integral HP V-Belt drive Type PB Fluidyne Pump

10 REASONS WHY THESE PEERLESS END SUCTION PUMPS OUTPERFORM IN GENERAL PURPOSE APPLICATIONS

1. They're ECONOMICAL. Designed with economy in first cost, installation, maintenance and operation—all without compromise in quality.

2. They're DURABLE. Every consideration has been given in design and construction to assure long service life even under abnormal service.

3. They're EFFICIENT. In all sizes, types and models the Fluidyne line is characterized by high performance ratings.

4. They're VERSATILE. Indoors or out, every general utility pumping service can use Peerless Fluidyne Pumps.

5. They're COMPACT. Space costs money; Fluidyne pumps fit neatly into both piping and pumping layouts as well as into subassemblies.

6. They're EASILY MAINTAINED. No special tools are required to perform ordinary pump maintenance in the Peerless line.

7. They're DEPENDABLE. Ample safety factors assure performance on continuous or intermittent duty, regardless of mounting angle.

8. They're GOOD LOOKING. Pleasing, trim and compact, their sturdy exterior design makes for neat installations.

9. They're HYDRAULICALLY CORRECT. Peerless impeller and volute design assure nonpulsating, non-turbulent liquid flow.

10. THE LINE IS COMPLETE. The Peerless Fluidyne line is one of the broadest offered by any manufacturer. Drives: electric, belt or flexible coupled; Hp range: from ¼ to 150 hp; Capacities: up to 5500 gpm; Heads: up to 260 ft. Write for descriptive bulletin today.

NEW BULLETIN
describes additional features of both fractional and integral hp pumps in the Peerless Fluidyne Line. Write for your copy of this 24-page fully illustrated and descriptive bulletin by mailing coupon today for Bulletin B-2300.

MAIL COUPON TODAY

Peerless Pump Division,
Food Machinery and Chemical Corpartion
301 West Avenue 26, Los Angeles 31, Calif.

Please send without obligation new Bulletin B-2300 describing Fluidyne line of fractional and integral hp pumps.

NAME_____

COMPANY_____

STREET_____

CITY_____ STATE_____

POW

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, Calif. and Indianapolis, Indiana.
Offices: New York; Atlanta; Chicago; St. Louis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.
Distributors in Principal Cities; Consult your Telephone Directory.

PEERLESS PUMPS
fmc

Save time...

ENGRAVE your own NAMEPLATES

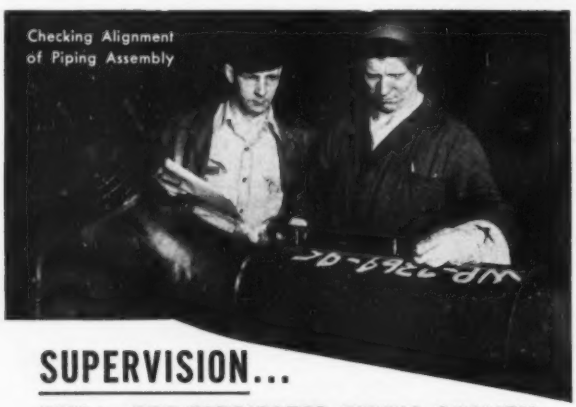
DIALS • PANELS

The fastest, easiest method for engraving individual nameplates, dials and panels.

- Automatic depth regulator.
- Engraves 15 sizes from One master alphabet.
- Equipped with self-centering device.

Send for Catalog IM 58

NEW HERMES, Inc. 13-19 University Place, N.Y. 3
In Canada: 359 St. James St., Montreal
World's Largest Manufacturer of Portable Engraving Machines


Checking Alignment of Piping Assembly

SUPERVISION...

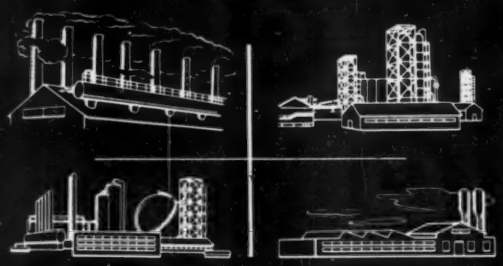
KEY to PRE-FABRICATED PIPING QUALITY

Every step in the fabrication of piping at Western Piping Supply is made under close and continuous supervision. From the day the customer's drawing enter the plant until the completed assemblies leave, this exact control is never compromised. "Watch-dogging" like this always assures WPS customers accurate, trouble-free installations in the field.

WESTERN PIPING SUPPLY DIVISION
THE LUMMUS COMPANY
504 WEST 145TH STREET, EAST CHICAGO, INDIANA
Representatives in Major Cities
FABRICATORS OF CARBON AND ALLOY PIPING

Use PALMETTO® Supersheat®

the Universal Sheet Packing for General Industry



Palmetto Supersheat #2900 is the industry-wide choice as an all-service flange and joint sheet packing for super-heated and saturated steam at all pressures and temperatures. Recommended also for air, ammonia, gas, acid, alkali and other applications. Look for the Palmetto trademark!

Gives Basic "3-R"* Performance Maintenance Departments Need

* It's *Rugged*—Exceeds Fed. Spec. HH-P-0046. Made of selected long-fibre asbestos pressure-bonded with special heat and chemical resisting bonding materials.

* It's *Resilient* — Compensates for expansion and contraction of flanges. Compressible to meet flange surface irregularities.

* It's *Reliable* — No variance in performance. Homogeneous construction eliminates ply separation. Heat, chemical and pressure resistant.

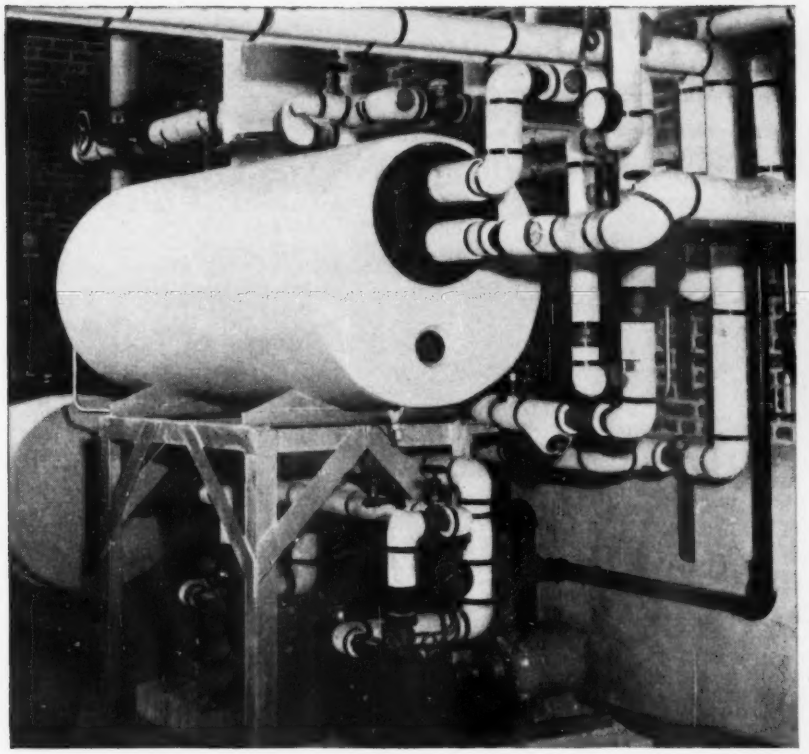
OUR 90th YEAR — NEARLY A CENTURY OF *Quality*

INVESTIGATE! Write for new Bulletin SP-22 to get details on Palmetto Supersheat—and other fine Sheet Packings and Gaskets for *special* conditions.

PALMETTO Packings

packing more performance into every application

GREENE, TWEED & CO. North Wales, Pa.



SCHAUB
BOILER RETURN SYSTEMS

Model S6F Schaub Duplex Deaerator System at the Lawrence Hose Co. (formerly Anchor Thread Co.), Lawrenceville, N. J. Of the 200 H. P. total load, 50% is live steam usage, with 15% returns from a hot water storage heater and 35% returns from high pressure unit heaters.

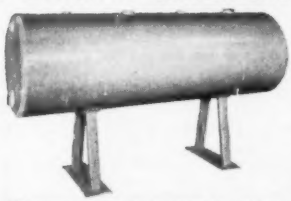
Judge on Facts...Prove to Yourself —

SCHAUB'S YOUR BUY!

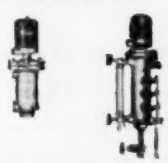
Look at Schaub's three outstanding *exclusive features.* Check them point for point with your own experience. Then you'll realize how much more these *plus values* really mean...and why a Schaub System can actually give you more—in low-cost maintenance, improved operating economy . . . and enduring dependability for many years to come. In short, you can't afford to buy a boiler return system until you know the Schaub story ...then, you won't be satisfied with less.

Only* SCHAUB *Has This Exclusive Combination of Features . . .

No more periodic pump maintenance! Schaub Master-Bilt Pumps have new Fleximatic Mechanical seals and permanently lubricated ball bearings. No more water puddles. No more scored shafts. No pump packing or greasing to do—ever!



10-year receiver corrosion guarantee. Schaub engineers worked with leading chemical researchers to develop the Chromosoid lining. You're safe from costly premature replacements. No more rust-clogged systems.



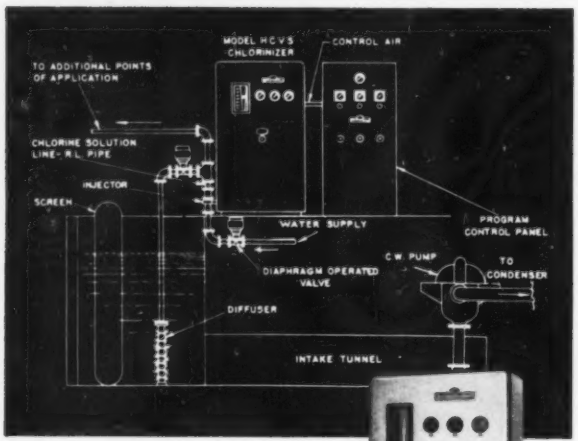
Schaub Systems use only proven super-SAFE Magnetrol pump control and low-water cut off. No bellows to stiffen, no packing to bind, no tricky electrode circuits to fail. Magnetrol's tireless, friction-free magnetic force provides ultra-dependable switching action at all times. BOILER SAFETY KNOWS NO PRICE.

Schaub also builds Patented Heat-Reclaim and Spray-Type Deaerating Systems for exacting requirements from 10 to 1000 Boiler Horse Power. Write for new Schaub Catalog No. 55 which gives more information on all types of Schaub Systems.

FRED H. SCHAUB ENGINEERING COMPANY

2105 S. Marshall Boulevard • Chicago 23, Illinois

Slime Control
IN COOLING SYSTEMS



Chlorination — the modern way to prevent slime buildup in condensers and heat exchangers — saves you money if it's right. But if dosage is too heavy, you run the risk of corrosion . . . or if it's too light, chlorination is worthless.

Builders Chlorinizer is the key to safe, effective, economical chlorination in cooling systems. CHLORINIZER IS ACCURATE . . . The sensitive compensating valve and the visible-flow Sightflo Indicator guarantee correct feed for effective treatment and insure against corrosion. CHLORINIZER IS SAFE . . . The full vacuum principle automatically and positively shuts off chlorine feed on loss of vacuum. CHLORINIZER IS SIMPLE . . . Because of its basic design, Chlorinizer is readily adaptable to single or multiple point applications on manual, semi-automatic, or fully automatic control.

Builders Chlorinizers are available in three volumetric models for feeding from a few pounds to 6,000 pounds per day. Send coupon for complete details.

BUILDERS-PROVIDENCE, INC.

B-I-F INDUSTRIES (DIVISION OF B-I-F INDUSTRIES) BUILDERS

354 Harris Avenue, Providence 1, Rhode Island

Please send Application Memo No. 840-J9 describing Chlorinizer slime control system.

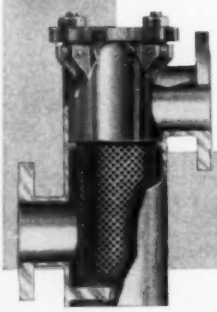
Name.....

Company.....

Street.....

City.....State.....

USE ADSCO

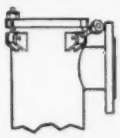


S-Type ADSCO Strainers screen out foreign matter from oil, water, and other liquid lines. Damage to valuable equipment is prevented. Usually installed on suction side but can also be used for discharge or other services.

S-TYPE

STYLE B COVER

Toggle and Bolt Type



Cover held in place by toggle bolts. This design simplifies removal of cover while cleaning basket screen. In sizes from 4" to 12", for pressures to 50 psi.

STRAINERS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

Write for POWER'S "Reprint Folder"

Giving summaries and prices on Power's famous

SPECIAL REPORTS

the best condensed handbooks in the field

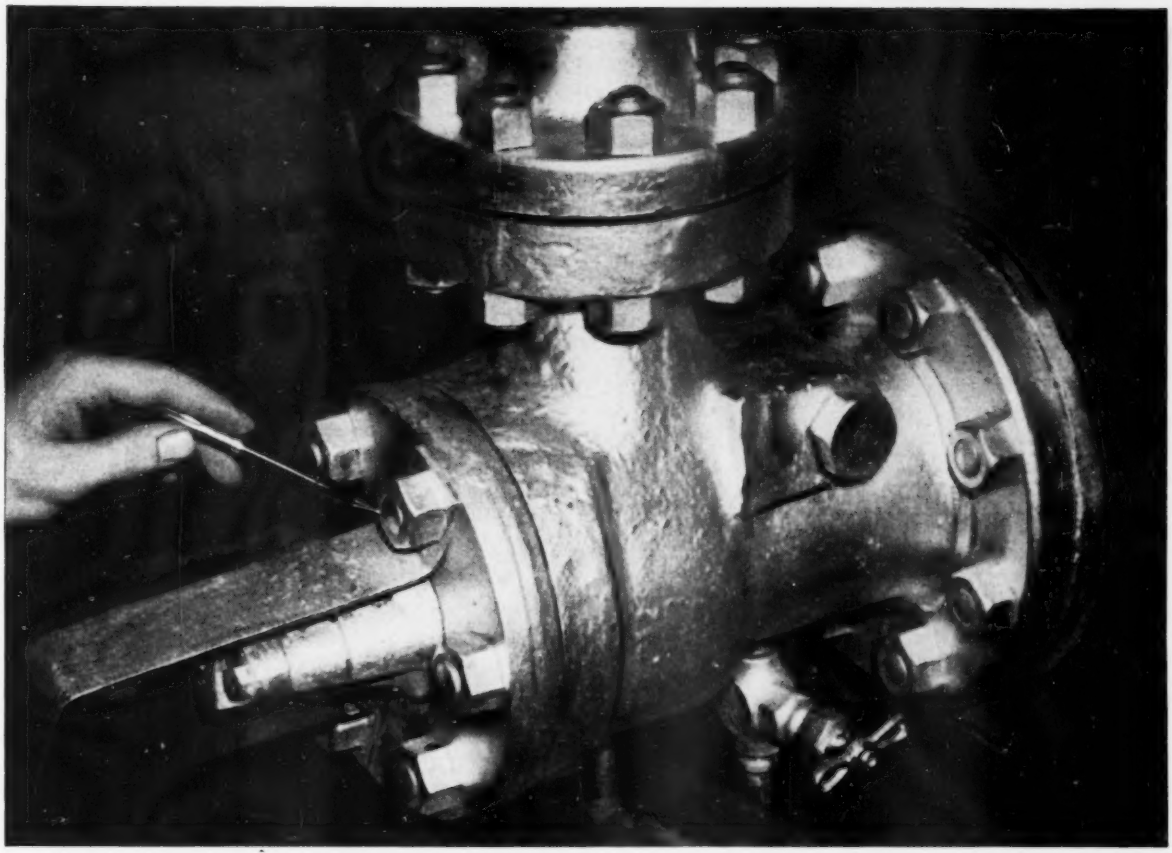
Power, 330 West 42 St. 3/53
New York 36, N.Y.

Gentemen: Please send me a copy of Power's "Reprint Folder".

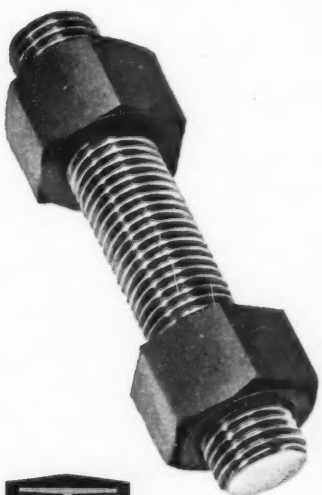
Name .....

Address .....

City & State .....



LET TEMPERATURES SOAR... THIS COMBINATION CAN TAKE IT



There's no need to worry about premature fatigue failure in high-temperature, high-pressure service when you use the Bethlehem Continuous-Thread Stud, with two Bethlehem Quenched Nuts. For this combination can take it, week after week, month after month.

The Bethlehem Continuous-Thread Stud resists failure because it has no point of thread runout. Stresses, instead of hitting at one point on the stud, are distributed over its full length.

The Bethlehem Quenched Nut is made from .40 to .50 carbon steel by forging and extruding the hot steel in a forming die. It is then quenched and tempered. This treatment makes the nut stronger than virtually any stud or bolt on which it may be used.

Both the Bethlehem Continuous-Thread Stud and Quenched Nut come in a wide size range, to meet virtually every need. Additional information may be obtained by writing to the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Bethlehem supplies every type of Fastener

"GUNITING" with *Super* ADACHROME-CAST

Tradename "Guniting" courtesy Cement Gun Co., Allentown, Pa.

...SAVES OUTAGE TIME and MONEY

Use **SUPER ADACHROME-CAST** to gunite your stud tube water walls.—Fine-grained to penetrate the small apertures between studs.—packs to a dense mass when shot. One user reports **SUPER ADACHROME-CAST** lasted twice as long and took but one-third the time to apply as compared with a plastic chrome ore installation.

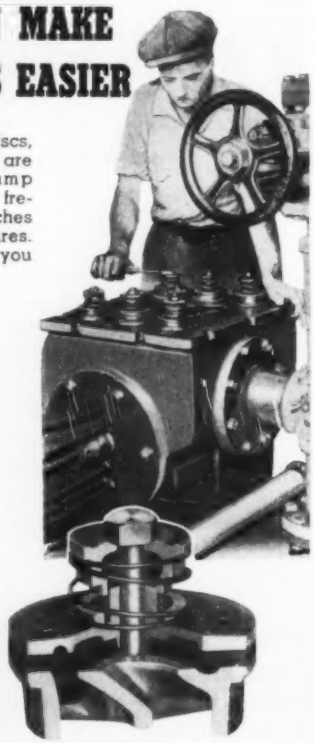
Excellent for coating brickwork when free of slag.

Yours, *FREE* for the asking . . . an illustrated, detailed Bulletin on *Super* ADACHROME-CAST.

BOTFIELD REFRACTORIES CO.

784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

HOW YOU CAN MAKE PUMP REPAIRS EASIER



Worn seats and valve discs, broken springs and stems are eliminated with Sims Pump Valves. Sims valves cure frequent pump repair headaches with exclusive design features. They're **guaranteed** to give you better pump performance.

You get longer service from seats and discs because of rotating disc that changes to a new seating-surface every time it opens. Valves can't hammer up and down.

Inclined rib seat and shock-absorber stem heads combine to permit increased speed without valve-knock. Capacity can be increased 40% and more.

Low resistance through seat reduces turbulence — gives protection against vapor binding.

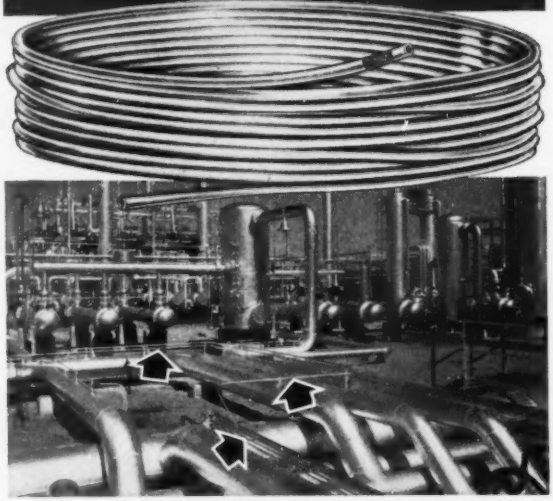
Long guide gives even lift — reduces wear. Spring is protected against jamming.

Write for new catalog showing how Sims valves fit your pump and give better pump performance.

SIMS PUMP VALVE CO., INC.

1314 PARK AVE., HOBOKEN, N. J. • M & M BLDG., HOUSTON, TEX.

Save 40% with ALCOA UTILITUBE



Instrument air lines of ALCOA Aluminum Coiled Tube, still in good condition after five years of outdoor service at Sun Oil Company's Delhi (La.) Gasoline Plant, have required no maintenance since they were installed early in 1948.

ALCOA UTILITUBE* is aluminum coiled tube made of a specially selected alloy to provide low cost, easy workability and high fatigue strength.

Alcoa Utilitube offers savings up to 40 per cent over copper . . . has excellent on-the-job forming and flaring properties. It is available in economical, long lengths up to 1,000 feet or more, depending on size. It stands up well under vibration . . . has high resistance to most industrial atmospheres and to many liquids and gases.

Use Alcoa Utilitube for:

- Air for pneumatic and hydraulic control circuits and brake lines.
- Gasoline and fuel oil for internal combustion engines.
- Lubricating oils for engines and machines.
- Fluids for hydraulic systems.

For complete details, write for the new booklet: "Alcoa Utilitube."

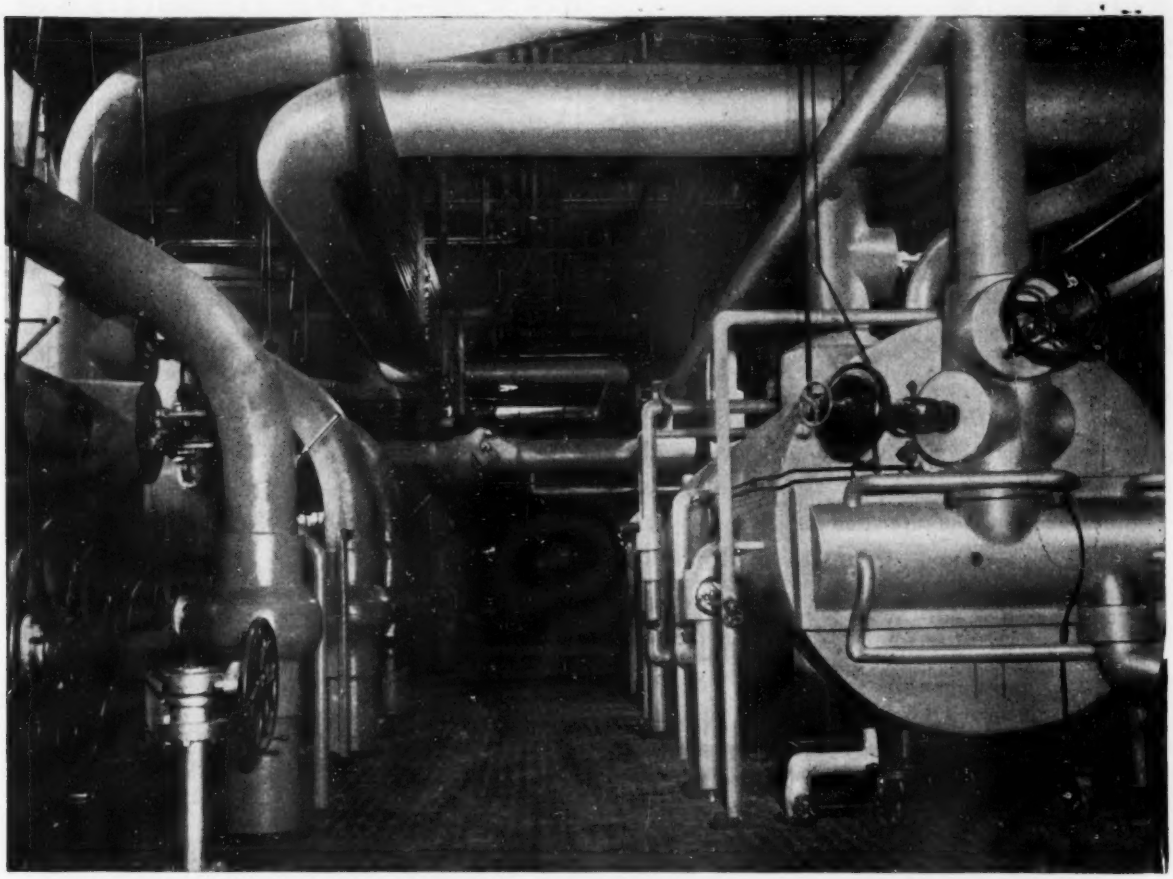
ALUMINUM COMPANY OF AMERICA
1004-D Alcoa Building, Pittsburgh 19, Pa.

For process chemicals—catalysts, catalyst supports and desiccants—investigate ALCOA *Chemicals.*

*Registered Trademark, Aluminum Company of America

Alcoa Aluminum

ALUMINUM COMPANY OF AMERICA



Scene in large southern power station. Main steam line and feeder equipment insulated with K&M Hy-Temp and "Featherweight" 85% Magnesia, in combination

Save heat-Save dollars

with K&M high-temperature insulations

For applications up to 1900°F., the combination to keep in mind is that of K&M Hy-Temp Insulation and "Featherweight" 85% Magnesia.

Two separate layers of insulation with vertical and horizontal staggered joints eliminate heat loss which occurs when expansion of hot piping and equipment causes joints to open in single layer installations. K&M Hy-Temp Insulation (diatomaceous silica), effective up to 1900°F. is applied directly to the hot surfaces and "Featherweight" 85% Magnesia Insulation (85% basic carbonate of Magnesia and asbestos fiber), effective up to 600°F. forms the second layer.

This effective K&M combination will last the life of the equipment it serves —will withstand moisture, vibration, alternate heating and cooling, wetting and drying. Both materials are supplied in all appropriate forms and thicknesses.

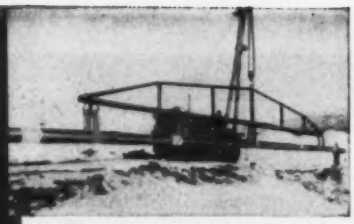
Your K&M distributor is an experienced applicator who will gladly give you more information about these heat-saving, money-saving K&M insulations. Or write directly to us.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In Canada: Atlas Asbestos Co., Ltd., Montreal, Toronto, Winnipeg, and Vancouver

SPEED WORK ON **RUSH** PIPING PROJECTS



CONTRACTOR INGENUITY — By using a suspension boom, here is how one contractor saved time by welding five 21-ft. Ric-wiL units together above-ground before lowering into trench.

WITH RIC-WIL PREFABRICATED INSULATED PIPING

SPEED "on-the-job" is a major factor in the installation of underground piping — from the standpoint of costs, man hours, and interruption of vital utility services.

Whether you are piping steam, hot water, oil, or process liquids, Ric-wiL prefabricated units are designed for quick, economical installation. Furnished in 21-ft. lengths, pipe and insulation per job specifications are pre-assembled inside a heavy-duty conduit housing for permanent protection and high efficiency!

FORM 5205 will acquaint you with the complete range of Ric-wiL piping systems and related products. Furnished on request.

Ric-wiL PREFABRICATED INSULATED PIPING

UNDERGROUND OR OVERHEAD

THE RIC-WIL COMPANY · CLEVELAND, O.

ONE CONTROL DOES THE JOB OF TWO

DA-400

Available with Explosion-Proof or Weatherproof Housing

Mercoid DA-400 Series Pressure Controls incorporate a single bourdon tube which actuates two independently adjustable Mercoid magnet operated mercury switches to accomplish various circuit operations. For example:

1. Close one alarm circuit at high pressure and another at low pressure with both circuits open over operating range.
2. As an electrical interlock to open one circuit as pressure rises above and the second circuit as the pressure drops below operating range.
3. To provide two-stage control by opening or closing one circuit on a rise in pressure and the second circuit on a further rise in pressure.

Equipped with calibrated dial and outside adjustments—Ranges 0-30 psi to 300-2500 psi—The Mercoid magnet operated mercury switches are not affected by harmful effects of dust, dirt, or corrosion—your assurance of millions of operations.

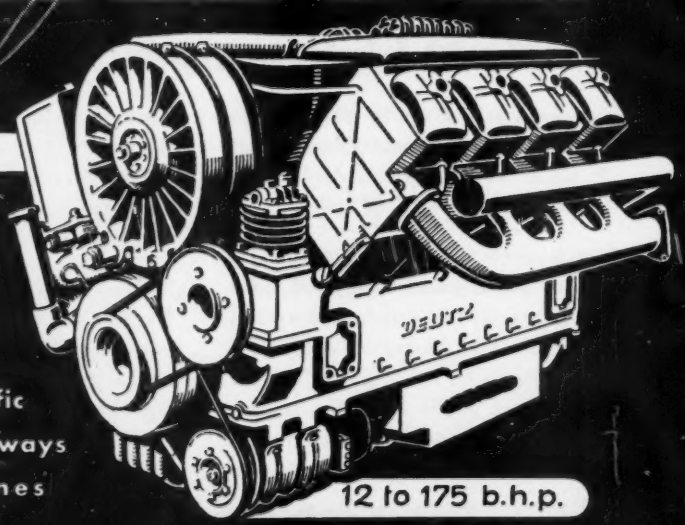
Write for Bulletin 5P

THE MERCOID CORPORATION
4201 BELMONT AVE., CHICAGO 41, ILLINOIS, U.S.A.

DEUTZ

Diesel

air cooled



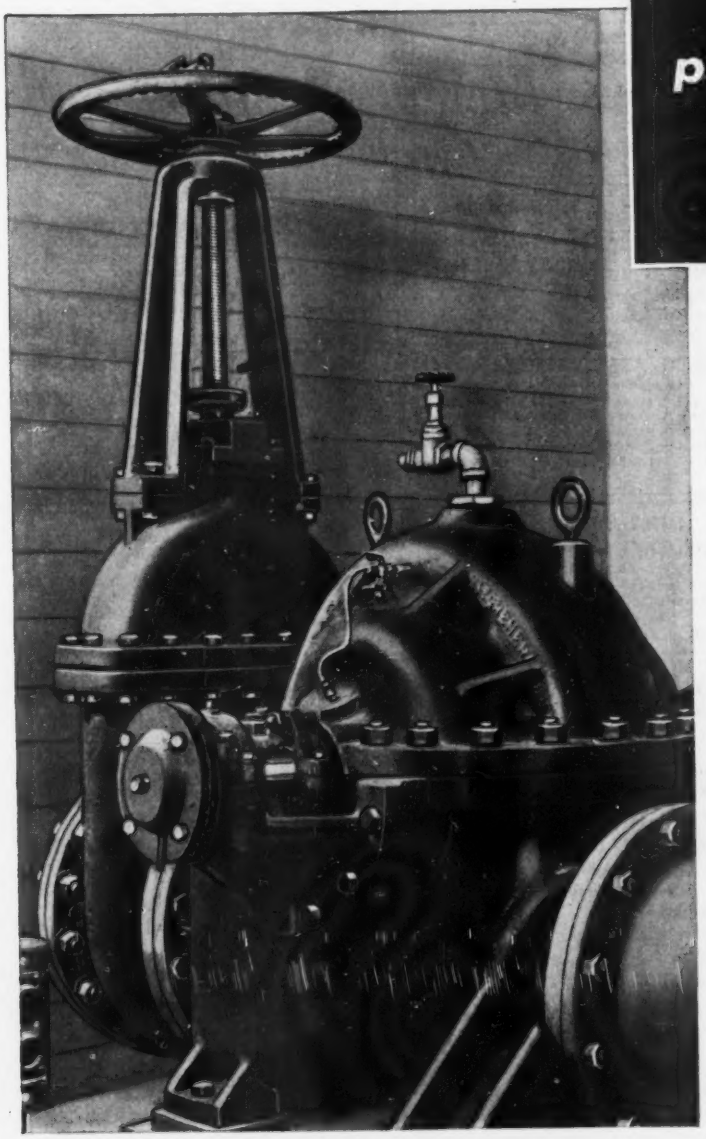
for
road and rail traffic
ships on all water-ways
working machines
for all applications

12 to 175 b.h.p.

KLÖCKNER-HUMBOLDT-DEUTZ AG · KÖLN
GERMANY

"Buffalo" Tips on Better Pumping

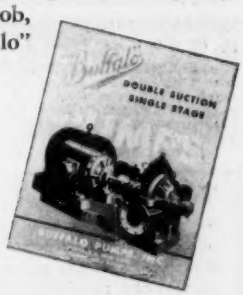
The cheapest pump is the one that lives up to expectations



"Buffalo" Type SL Double Suction Pump. For Engineering data, write for Bulletin 955.

First cost is the smallest part of what the wrong pump could cost you, once installed. If it fails to meet capacity and pressure requirements, it means costly replacement or supplementary pump units. Or if the pump is not built to stand up on the job, the owner is in for more expense and dissatisfaction.

"Buffalo" Pumps cost a little more to build—and by the same token, a lot less to run. Only the finest workmanship and materials go into them. Impellers, shafts, stuffing boxes and bearings are oversize. Water passages are simply formed. All parts are readily accessible. And whether you need a boiler feed pump to handle 300 gpm at 1400′ head, a water pump to handle up to 10,000 gpm, or a single suction pump for, say, zone air conditioning, "Buffalo" makes the right model and size for the job. What's more, you can be sure of performance right up to rated capacity. On your next job, make it "Buffalo" and see.



BUFFALO "Buffalo" PUMPS, INC.

488 BROADWAY BUFFALO, N. Y.

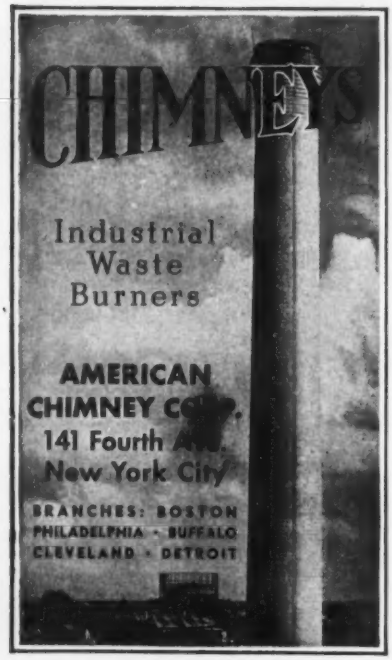
Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

WHERE TO BUY

Featuring additional products, specialties & services for power plants



GAGE GLASSES AND
High Pressure Rubber Gaskets
ALL SIZES TO FIT YOUR WATER GAGES

ERNST WATER COLUMN & GAGE CO.
Send for Catalog LIVINGSTON, N. J.

STOP *that* WATER

With FORMULA NO. 640, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in. Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. $3 in 55's. Free sample. See Sweet's.
HAYNES PRODUCTS CO., OMAHA 3, NEBR.

TO manufacturers of equipment and those offering special services to the power industry, this section offers an inexpensive means of keeping products or services regularly before your potential customers — the readers of POWER. The small spaces available here provide opportunity for you to be represented in every issue at low cost. Can we serve you?

Classified Advertising
POWER

PROFESSIONAL SERVICES

AMERICAN CALIQUA COMPANY
Consulting Engineers
HIGH TEMPERATURE WATER DISTRIBUTION SYSTEMS
Space Heating and Industrial Processing
District and Municipal Heating
222 East 41st St., New York 17
MUrray Hill 7-0161

BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City, Mo. — P. O. Box 7088
Cleveland, Ohio — 1404 E. 9th St.

CARNAHAN & THOMPSON
ENGINEERS
Mechanical and Electrical Consultants
320 Oklahoma Natural Building — Oklahoma City 2 Oklahoma

GILBERT ASSOCIATES INC.
Engineers and Consultants
Industrial and Utilities, Power Plant Design and Construction. Rehabilitation and Maintenance.
Steam — Diesel — Hydro — Sewage
Reports — Examinations — Laboratory
New York Houston — Reading, Pa. — Philadelphia Washington

INTERNATIONAL ENGINEERING COMPANY, INC.
Engineers
Investigations — Reports — Design
Procurement — Field Engineering
Domestic and Foreign
74 New Montgomery St., San Francisco 5, Calif.

THE KULJIAN CORPORATION
Engineers - Constructors - Consultants
Power Plant Specialists
Utility — Industrial — Chemical
1200 N. Broad St. — Philadelphia 21, Pa.

LARAMORE AND DOUGLASS, INC.
Consulting Engineers
POWER PLANTS
TRANSMISSION — DISTRIBUTION
DESIGN—REPORTS—APPRAISALS—RATES
79 East Adams Street — Chicago 3, Illinois

LUTZ AND MAY
Consulting Engineers
STEAM, GAS & DIESEL POWER STATIONS
PUMPING PLANTS—ELECTRIC SYSTEMS
REPORTS—DESIGN—APPRAISALS
1009 Baltimore — Kansas City 6, Mo.

PETER F. LOFTUS CORPORATION
Engineering and Architectural Consultants and Designers.
1st National Bank Bldg., Pittsburgh 22, Pa.
Cable Address—"LOFTUS—Pittsburgh"

MORAN ENGINEERS
Designers and Consultants
Buildings — Power Plants
Air Conditioning — Ventilation
30 Church St. — New York 7, N. Y.

FRED LEROY PEARSON, NSPE
Consulting Engineer
Mechanical — Electrical
1231-38 Majestic Bldg., Detroit 26, Michigan

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers
Purchasing Specialists in
Financing, Accounting & Other Operations
231 So. La Salle St. — Chicago 4

SANDERSON & PORTER
Engineers and Constructors
New York • Chicago • San Francisco

SARGENT & LUNDY
Engineers
140 South Dearborn St. — Chicago, Illinois

J. E. SIRRINE COMPANY
Engineers
Power Plants — Consultations
Design — Reports
Water — Steam Utilization — Plants
Greenville — South Carolina

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam — Diesel — Hydro
Design — Construction — Test — Valuation
Hershey Building — Muscatine, Ia.

JOHN A. STEVENS, INC.
Established 1909
Consulting Engineers
Power Plant — Paper Mills
Dye Houses — Surveys
Lowell, Massachusetts

SYSKA & HENNESSY, INC.
Engineers
Consultation — Plans — Reports
Power Plants — Disposal Plants
Water Systems
114 East 39th Street
New York, New York

WATER SERVICE LABORATORIES, INC.
Specializing Since 1927
Water Treatment for corrosion control in buildings, boilers and air conditioning systems.
New York—Philadelphia—Washington, D. C.

THE J. G. WHITE ENGINEERING CORPORATION
Design-Construction-Reports-Appraisals
89 Broad Street, New York 4

Have you a fly ash recovery problem?

Bring it to WESTERN PRECIPITATION

. . . The Only Organization With Years Of "Know-How" In BOTH *Electrical* And *Mechanical* Recovery Methods!

If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field . . . WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

Result:

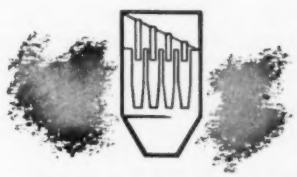
Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields . . . knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* . . . can give you a direct and unbiased recommendation on the matter . . . and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

Western Precipitation products and services include . . .

COTTRELL

Electrical Precipitators

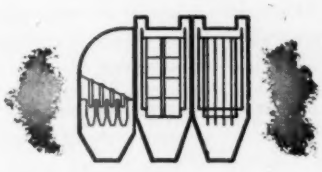
. . . the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation* COTTRELLS *give highest recovery at lowest cost per-year-of-service!*



MULTICLONE

Mechanical Collectors

. . . the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.



CMP UNITS

(Combination Multiclone-Precipitator)

. . . combine, in *one* compact installation, *both* mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) . . . and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!

Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1049 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

MULTICLONE—T.M. Reg.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

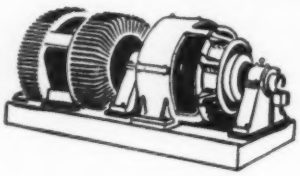
UNDISPLAYED RATE
$1.50 a line. Minimum 3 lines. To figure advance payment count 5 average words as a line. (See ¶ on Box Numbers.)
POSITION WANTED and Individual Selling Opportunity Wanted undisplayed rate is one-half of above rate, payable in advance.
PROPOSALS, $1.50 cents a line an insertion.

INFORMATION
BOX NUMBERS count one additional line in undisplayed ads.
DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).
EQUIPMENT WANTED or FOR SALE Advertisements acceptable only in Displayed Style.

DISPLAYED RATE
The advertising rate is $16.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. PR.

NEW ADVERTISEMENTS, N. Y. Office, 330 W. 42nd St., N. Y., for the May issue closing April 12th

SEARCHLIGHT EQUIPMENT SPOTTING SERVICE



This service is aimed at helping you, the reader of POWER, locate used and surplus new power equipment not currently advertised (this service is for user-buyers only).

Just send in the specifications of the equipment wanted on the coupon below, or on your own company letterhead, to

Searchlight Equipment Spotting Service
c/o POWER
330 W. 42nd St., N.Y. 36, N.Y.

Your requirements will be brought promptly to the attention of the used equipment dealers advertising in this issue. You will receive replies directly from them.

NO CHARGE • NO OBLIGATION

Searchlight Equipment Spotting Service
c/o POWER
330 W. 42nd St., New York 36, N. Y.

Please help us locate the following used equipment:

.....

.....

.....

.....

NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

4/53

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ASSISTANT TO Chief Engineer in municipal steam power plant of 22,500 KW. Should have knowledge of operation and maintenance of steam turbines, motors, pumps, boilers, combustion control and feedwater treatment. Need initiative and supervisory ability. Advancement opportunity excellent. Location—Southwest. Starting Salary —$4000.00 to $4200.00. P-7232, Power.

MECHANICAL ENGINEER:—Assistant to Chief Engineer in Steam Speciality and Control field. Experienced in design or application of pneumatic controls and high pressure control valves desirable. Excellent opportunity for varied experience and advancement. Give complete details of experience, education, and salary expected. P-7128, Power.

PIPING ENGINEER—Salary Open. Fast growing Construction Company wants Piping Engineer capable of making detailed material take offs on Powerhouse, Chemical, Paper Mill and Oil Piping, and handling buying of same. Location central Southeast, most work lump sum. In experience record clearly separate engineering from actual construction experience, give salary and direct supervisor each previous job, as well as at least 4 references familiar with your work. Will pay whatever salary ability justifies. P-6682, Power.

EMPLOYMENT SERVICE

SALARIED PERSONNEL. $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

LICENSED MARINE Chief Engineer, age 28. Technical school grad. in mechanical and electrical engineering. 10 years experience. Desires position. PW-7247, Power.

SELLING OPPORTUNITY WANTED

MANUFACTURERS REPRESENTATIVE, long established in Philadelphia Territory, desires additional account in Power Plant or Process Equipment Field. RA-7107, Power.

WANTED

ANYTHING within reason that is wanted in the field served by Power can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

Now Available

YOUNG ENGINEER WITH EXPERIENCE

Six years excellent experience as chief engineer of large Midwest processing plant. Not yet 35. Have supervised 10 man engineering department, installed nearly $500,000.00 worth of electric, steam and processing equipment in recent plant modernization. B.S.M.E. with some specialized post-graduate work, plus over two years engineering and command duty afloat in the Navy. Presently employed in $9000 bracket but desire a top engineering position in the power or process fields on the West Coast, preferably in Northern California.

PW-7037, POWER
68 Post St., San Francisco 4, Calif.

OPPORTUNITIES FOR ELECTRICAL ENGINEERS WITH GOODYEAR ATOMIC CORPORATION

Electrical Engineers with BS or MS degrees, or the equivalent in training and experience, required to staff the Engineering Division of the Billion Dollar Atomic Plant now under construction near Portsmouth, Ohio. Fields of opportunities include:

- **Design, Construction, Operation and Maintenance of High Voltage Transmission and Distribution Systems. Operating and dispatching experience on 154 KV systems highly desired.**
- **Design, Development and Maintenance of Electronic Control Systems.**

Reply by letter stating education, work experience and salary required.

Industrial Relations Division

GOODYEAR ATOMIC CORPORATION
1144 E. Market St., Akron 16, Ohio

ENGINEERS
ASSOCIATE ENGINEERS
●
MECHANICAL
ELECTRICAL
GAS

WANTED BY RAPIDLY GROWING ELECTRIC AND GAS COMPANY ON EAST COAST

Experienced Engineers required in Engineering Department for expansion program covering Steam Power Plants, Electric Generation, Transmission and Substations and Gas Production and Transmission. Jobs offer permanent employment with ample advancement opportunities for men with ability and initiative.

Pleasant congenial suburban community in close proximity to a Metropolitan Area.

Write giving full particulars of education, experience, and salary to:

P-7321, POWER
330 W. 42 St., New York 36, N. Y.

When required personal interviews will be arranged for evenings or Saturdays.

CONSTRUCTION ESTIMATOR AND COST CONTROL MAN

Must be thoroughly experienced in quantity take-offs and estimating and have successful performance record in competitive bidding. Cost control experience required. Background in Power Plant work, Process Piping and General Industrial Construction absolutely essential. We are looking for a man who has been successful as a Chief Estimator and is seeking a permanent staff position. State education, experience, and salary requirements. All applications will be acknowledged. Location Philadelphia.

P-7305, POWER
330 W. 42nd St., New York 36, N. Y.

DEVELOPMENT ENGINEER MECHANICAL

Young, vigorous company requires the services of a Development Engineer to supervise redesign of existing products and to assist in creation of new products. Work may also include design of necessary tooling. This is a fine opportunity for a permanent and challenging position.

This company manufactures automatic coal scales, coal valves and other items used by large steam boiler plants. We have enjoyed a good growth record which insures opportunity.

Development Engineer must have high college scholastic record. Age 30 to 40. Must be able to take responsibility and direct work of others. Experience in automatic machinery, machine tools or similar fields is necessary. Some knowledge of patents is desirable. Salary. Location — Cleveland, Ohio. **Write:**

ARTHUR J. STOCK, *President*
STOCK EQUIPMENT COMPANY
745 HANNA BUILDING
CLEVELAND 15, OHIO

GET 2nd ENGINEER PAPERS IN 1 YEAR

(Yes, get better stationary engineers License!)

No correspondence school bother. Nationally-known Chief Stationary Engineer Frederick C. Walker's 100-Question, 100-Answer Bulletins give you the straight dope quick. Send $3 to Walker & Collins, 524 Ashland Ave., Buffalo 22, N. Y. for first set today. Keep working. Save year.

FOR SALE
Unused G.E. 1750 H.P. Motor

3600 RPM, squirrel cage induction, complete with starting switchgear.

PITTSBURGH CONSOLIDATION COAL CO.
Research and Development Division
LIBRARY, PENNSYLVANIA

FOR SALE
BOILERS & HEATING EQUIPMENT

Three 4-drum Sterling boilers, approximately 450 HP ea., Bros stokers, feed pumps, pre-heaters, coal conveyors, ash removing machinery, etc. Many Fisher steam pressure regulators, extensive steam mains, expansion joints, several smaller boilers. All on railroad siding.

VETERANS' VILLAGE, INC.
Buckley Field, Denver 8, Colorado

MAGNETIC DRIVE

1—Size 44 Electric Machinery Magnetic Drive, Form MD-1 self-contained two-pedestal type including base, guard, double shaft extensions, drip-proof construction.

REGUTRON CONTROL

1—Electric Machinery Regutron Control in free-standing cabinet 30" x 30" x 76" with output of 230 volts D. C. and can be operated on 440 volt, 3 phase, 60 cycle service complete with rheostat for manual control.

Equipment still in original shipping crate.

ALTON BOX BOARD COMPANY
ALTON, ILL.

FOR SALE

400#—650° B&W Stirling 4 drum, Class XXII—22 Boiler with superheater and 6 retort underfeed stoker. Built in 1928.

400#—650° B&W Stirling 4 drum, Class XXII—33 Boiler with superheater and 9 retort underfeed stoker. Built in 1933.

1500 KW, G.E. 325# pressure, extraction condensing turbine, extraction @ 35#, 1500 sq. ft. condenser. Built in 1927.

Address inquiries to

FS 7309, POWER
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

BUYERS OF SURPLUS
Diesel Engines and Generator Sets
Motors—Generators—Transformers
Highest Prices Paid. Send us your lists.
W 7283, POWER
330 W. 42nd St. New York 36, N. Y.

WANTED
800 H.P. 600 VOLT DC MOTOR

Adjustable speeds 240 to 720 RPM—75 H.P. 2300/3/60/3600 RPM squirrel cage drip proof.

SOUL CLINIC INC., CALGARY, CANADA

Watch—
the *Searchlight Section*
for
Equipment Opportunities

CASH FOR SURPLUS
MOTORS
GENERATORS
TRANSFORMERS
COMPRESSORS
WORLD'S LARGEST INVENTORY

See our other ad on page 297

ELECTRIC EQUIPMENT CO.
ROCHESTER, N. Y.

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short
TELEPHONE: EASTGATE 7-4778

PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

ELECTRIC MOTORS AND GENERATORS

WAGNER CERTIFIED REBUILT

BACKED BY 47 YEARS OF QUALITY AND SERVICE

ANOTHER CUSTOMER TELLS WHY—

IT PAYS TO

"Check with Wagner First"

WAGNER "Certified Rebuilt" MEANS:

1. Thorough Rebuilding
2. Careful Testing
3. Honest Guarantee
4. Save Money Safely
5. Quick Shipment
6. Complete Quotations

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
600	Gen. Elec.	ATB	480	900
625	El. Machy.	Late	240/480	1200
485	Allis. Ch.	1 brg.	480	400
375	G.E.	ATI	240/480	1200
350	El. Machy.	1 phase	480	1200
312	Gen. Elec.	ATB	240/480	600
275	G.E. 25 cycle	ATI	480	750
225	El. Machy		480	720
225	Gen. Elec.	ATB	240/480	600
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
90	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
56	G.E.	ATB	240/480	1200

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Al. Ch.	MECW	125/250	1200
250	Allis Ch. b.b.	EW	250	1200
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1500 amp.	70	1200
100	Allis Ch.	E	125	1200
75	Cr. Wh. b.b.	CCD	250	1500
75	Whse.	SK	250	1200
60	G.E.	RC	250	1450
60	Whse.	SK160	250	1000
60	Gen. Elec.	LC	250	700
50	L.A. b.b.	GNA	240	1200
50	Allis Ch.	EW	125/250	1200
50	Gen. Elec.	RC	125	1200
40	Gen. Elec.	RC	600	1750
40	Gen. Elec.	RC	250	1150
25	G.E. b.b. New	CDM93	125	1500
20	Gen. Elec.	RC	125	1150
15	Star b.b. (10)	SQ	250	1500

D.C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	250	500
300	Allis Ch. b.b.	EW	350	1000
200	Al. Ch. b.b.	E	250	600/1000
150	Gen.Elec.	RC39	230	550
100	Whse.	SK	230	400/1200
75	Whse.	SK	230	1750
75	G.E. (2)	CD 115	230	1150
75	Whse.	SK163	230	850
60/75	Gen. Elec.	C	230	500/1200
50	Gen. Elec.	CD123	230	550/1200
50	Gen. Elec.	RC33	115	1100
40	Gen. Elec.	RC32	230	1100
35	G.E.	RF-14	230	250/1000
30	Imperial b.b.	D69	230	400/1600
30	Gen. Elec.	LC	230	500/1500
30	Whse.	SK110L	230	1150
30	Star b.b. (3)	SB	230	1750
25	Whse.	SK150	230	300/1200
25	G.E. b.b.	CDM93	115	1150
20	Whse. b.b. (2)	SK97	550	900

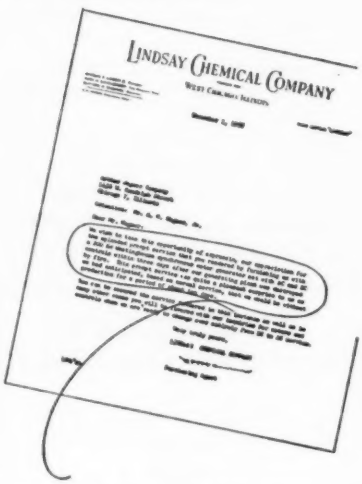
A. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
800	G.E.	Slipring	2300	400
750	Whse.	Synch.	2200/4000	900
700	G.E.	Synch.	2200	514
650	E.M.	Synch.	480	1200
500	G.E.	Sq. Cage	6600/4000	1800
500	G.E.	Synch.	440	900
500	G.E.	Slipring	2200/440	450
500	Al. Ch.	Synch.	440	400
450	Whse.	Synch.	2300	900
400	G.E.	Synch.	440	450
400	Allis Ch.	Sq. Cage	2200	1200
350	G.E.	Slipring	2200/440	300
350	Whse.	Slipring	2300	450
300	G.E.	Slipring	440	600
300	Allis Ch.	Sq. Cage	2200	1800
300	Al. Ch.	Sq. Cage	2200/440	720
300	El. Mach.	Synch.	2200/440	360
300	Whse.	Synch.	2200/440	600
300	G.E.	Slipring	2300	1800
300	Al. Ch.	Slipring	2300	514
300	G.E.	Slipring	440	360
250	G.E.	Sq. Cage	2300	450
250	G.E.	Slipring	2300	450
250	G.E.	Slipring	440	600
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L.A. (2)	Sq. Cage	2200	1800
225	G.E.	Synch.	220/440	600
200	G.E. TEFC	Slipring	440	1200
200	G.E.	Slipring	220/440	514
200	G.E.	Sq. Cage	220/440	600
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	G.E.	Slip Rings	220/440	600
200	E.M.	Synch.	220/440	1200
200	G.E.	Sq. Cage	220/440	1200
200	Al. Ch.	Synch.	440	360
200	G.E.	Slipring	220/440	360
200	G.E.	Sq. Cage	220/440	1800
200	Rel. b.b.	Sq. Cage	220/440	1200
200	E.M.	Synch.	220/440	514
160	Whse.	Synch.	220/440	600
150	G.E. TEFC	Sq.Cage	2200	3600
150	Al. Ch.	Sq.Cage	2200	3600
150	Rel. b.b.	Sq. Cage	220/440	1200
		Slipring	2200/440	720
150	G.E. (2)	Sq. Cage	2200/440	720
150	G.E.	Slipring	220/440	450

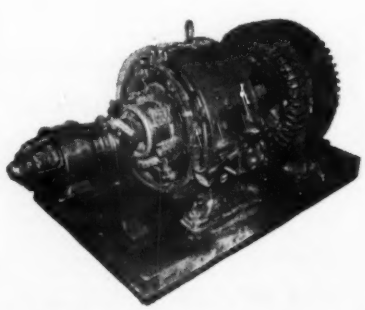
M-G SETS

KW	Mfr.	Input V		Output V	
500	Whse.*	2300	AC	250	DC
360	G.E.*	2300/4000	AC	250	DC
300	Allis Ch.	440	AC	125/250	DC
300	Whse.*	2300	AC	600	DC
250	Allis. Ch.	440	AC	350	DC
200	G.E.*	220/440	AC	250	DC
200	Gen. Elec.*	220/440	AC	125	DC
150	Whse.*	220/440	AC	125/250	DC
105	Century b.b.	220/440	AC	70	DC
100	Whse.*	2300/4000	AC	275	DC
100	Al. Ch.	220/440	AC	125	DC
100	Delco b.b.	220/440	AC	125/250	DC
100	Allis Ch.*	220/440	AC	50	DC
75	Whse.	440	AC	250	DC
60	Gen. Elec.*	220/440	AC	60	DC
50	Gen. Elec.	220/440	AC	125	DC
50	Allis Ch. (2)	220/440	AC	125/250	DC
45	Gen. Elec.*	220/440	AC	90	DC
40	Gen. Elec.	220/440	AC	250	DC
30	Otis (5)	220/440	AC	250	DC
25	Whse.	220/440	AC	125	DC
20	N.W.	220/440	AC	250	DC
20	Whse.	220/440	AC	600	DC
21	Whse.	220/440	AC	35	DC
17	Gen. Elec.	220/440	AC	125	DC

THESE ARE PARTIAL LISTINGS . . . 10,000 OTHER UNITS IN STOCK.


LINDSAY CHEMICAL COMPANY

"...expressing our appreciation for **prompt service** by furnishing us an M-G Set....**within three days** after our generating plant was destroyed by fire..."



The 200 KW Westinghouse synchronous motor generator set referred to in above letter from LINDSAY CHEMICAL CO.

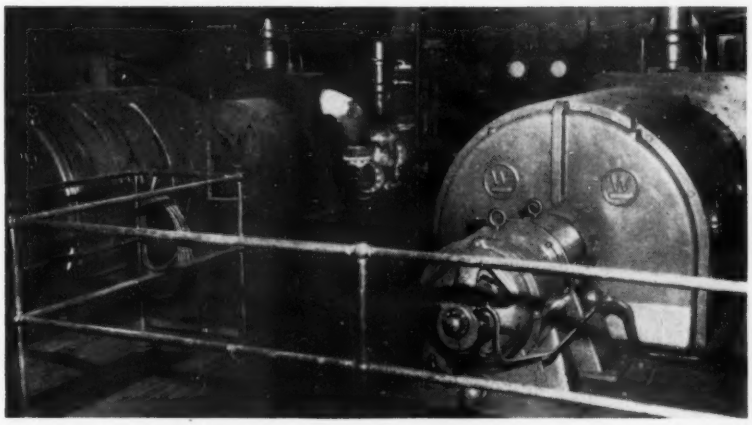
Gearhead Motors — Controls — Transformers

Arthur Wagner Co.

1435 W. RANDOLPH ST. MOnroe 6-7405 CHICAGO 7, ILLINOIS

2500 KVA
Modern Design

NON-CONDENSING TURBO-GENERATOR
Like a New Machine



Write now for Inspection Report and Drawings

Above Cut Was Made From Photograph Taken on Foundation of Our 2500-KVA., Westinghouse Non-condensing Turbo-Generator: A Very High Grade Modern (1935) Machine. Complete Unit With Direct Connected Exciter, Switchboard, Etc. DELIVERY, IMMEDIATE.

With Moderate Changes is Suitable for 400#, 700°TT., 50# Back Pressure.

WATER RATE:	KW. Load	1000	1500	2000	2500
	Lbs. KWHr.	27.1	25.85	26.0	26.2

BELOW IS A PARTIAL LIST OF OUR STOCK

TURBO-GENERATORS ALL 3600-RPM.

CONDENSING

No.			
1	500-KW.	A.-C.	150/200 psig. 480-V
2	500-KW.	G.-E.	150/200 psig. 480-V
3	625-KW.	G.-E.	160/200 psig. 480-V
4	750-KW.	A.-C.	150/200 psig. 480-V
5	750-KW.	West.	140/200 psig. 2300-V
6	750-KW.	A.-C.	150/200 psig. 2300-V
7	750-KW.	G.-E.	150/200 psig. 480-V
8	1000-KW.	G.-E.	175/250 psig. 2300-V
9	1000-KW.	A.-C.	125/200 psig. 2300-V
10	1500-KW.	A.-C.	150/200 psig. 2300-V
11	1200-KW.	G.-E.	175/200 psig. 2300-V
12	2000-KW.	G.-E.	150/200 psig. 2300-V
13	2500-KW.	G.-E.	150/250 psig. 2300-V
14	3000-KW.	G.-E.	150/250 psig. 480-V
15	4000-KW.	West., A. Ext.	275/400# 600-V
16	5000-KW.	G.-E.	150/200# 2300-V
17	5000-KW.	West.	250/400# 480-V.

NON-CONDENSING

No.				
1	500-KW.	A.-C.	125#:10/15 BP.	480-V
2	500-KW.	G.-E.	175#10/15 BP.	480-V
3	500-KW.	West.	250/400:125# BP.	2300-V
4	750-KW.	G.-E.	125#:10# BP.	480-V
5	1000-KW.	G.-E.	125#:15 BP.	480-V
6	1250-KW.	G.-E.	200/250 psig. 20# BP.	480-V
7	2000-KW.	West.	250/350#:35# BP.	2300-V
8	2500-KW.	G.-E.	150/175#:15# BP.	2300-V
9	3000-KW	A.-C.	425#750F:60# BP.	13200-V
10	4000-KW	G.-E.	425#, 75° FSH. 60# BP.	13200-V

BOILERS, ETC.

B&W., 600#, 100,000# Steam per hr.
2—Springfield 511-HP., 250# 1935
1—Springfield 900-HP., 400# 1932
2—B&W 604-HP., Cond. A-1

Please Send Us Your Specifications for Diesel Engines, Boilers, Pumps, Etc.
Our New Stock List Is Just Off the Press. Send for It.

CORRESPONDENCE INVITED.

TELEPHONE
WRITE OR
WIRE

CHARLES WEAVER
4145 PENOBSCOT BUILDING
DETROIT 26, MICHIGAN
ANYTHING FOR YOUR POWER PLANT

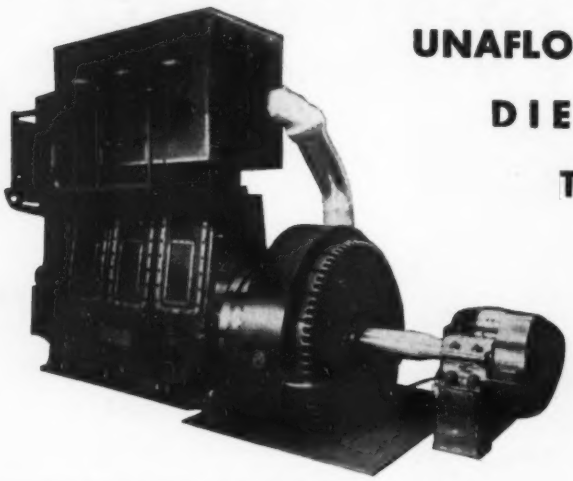
Telephones:
WO. 1-1340
" 1-1341
" 1-6038

SPECIAL BARGAIN OFFERINGS

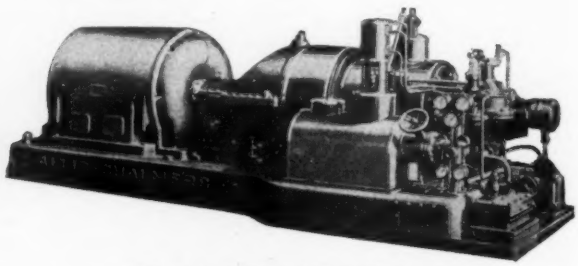
UNAFLOW ENGINE GENERATORS

DIESEL GENERATORS

TURBO GENERATORS



500 KVA GENERAL ELECTRIC 240 VOLT
SKINNER VERTICAL UNAFLOW UNIT



937 KVA ALLIS CHALMERS 480 VOLT
NON CON. UNIT

TURBINE GENERATOR UNITS

Condensing—3 phase, 60 cycle

6250 KVA G.E., 5-stage, 2300/4160 volts, 200# PSI, 600°TT.

6250 KVA Westghse., 480 volts, 400 PSI, 15# G. extract with condenser.

5000 KVA Westghse., 600 volts, 275 PSI, 25# G, extract with condenser.

4000 KVA Allis 2300 volts, 200 PSI.

3750 KVA Westghse. 2400/4150 volts, 350 PSI.

2500 KVA G.E., 2300/480 volts, 3600 RPM, generator **LESS TURBINE.**

1250 KVA Allis, 480 volts, 250 PSI, 25# G. automatic extraction.

1000 KVA G.E., 450 volts, 275-400 PSI, 750°TT geared unit.

940 KVA Westghse., 2300 volts, 180 PSI, mixed pressure automatic extraction.

940 KVA Elliott, 2300 volts, 3600 RPM generator **LESS TURBINE.**

625 KVA Elliott 2300 volts, 250 PSI.

Non-condensing—3 phase, 60 cycle

5000 KVA G.E., 13,800 volts, 600 PSI.

1563 KVA (1) G.E. 480 volts, 200 PSI, to 20# ga. back.

1250 KVA (2) G.E., 2300 volts, 150 PSI, 10# gauge back.

937 KVA ALLIS 480 VOLTS, 150#, 10# gauge back, excellent condition (photograph above).

625 KVA G.E., 2300 volts, 150 PSI, 40# gauge back.

500 KVA Terry, 480 volts, 325 PSI, 110# back.

125 KVA Westghse., 2400/480 volt, 125-250#, 5# ga. back. Geared unit.

UNAFLOW GENERATOR UNITS

3 phase, 60 cycle

750 KVA E.M. 240/480/600 volts generator connected Skinner Vertical engine, 150 PSI, 8# gauge back.

575 KVA G.E., 2300 volts generator connected Nordberg engine 200# PSI.

500 KVA G.E. 240 volts generator connected Skinner Vertical engine, 150-175 PSI complete. (actual photograph above).

375 KVA Westghse. 600 volts connected Skinner engine, 150 PSI, 10# back.

312 KVA G.E. 240 volts connected Skinner engine, 125 PSI, 5# back.

SPECIALLY PRICED

- **9000 sq. ft. Condenser Engineering, 7000 sq. ft. and 5000 sq. ft. Wheeler surface condensers.**
- **12000 GPM, 25' hd. Worthington circulating pump direct connected to 200 HP, 3/60/2300 volt G. E. motor.**
- **6000 GPM Dayton-Dowd circulating pump, 70' hd. direct connected to 125 HP, 3/60/2200 volt G.E. motor.**
- **3500 GPM Allis dual drive circulating pump, 70' hd. direct connected to 75 HP, 3/60/440 volt Allis motor.**
- **5000 KVA Westghse. synchronous condenser 3 phase, 60 cycle, 4000 volts 720 RPM.**
- **150,000# per hr. B&W (2) cross drum water tube boiler 250# pres. 125°F superheat, Taylor Stoker.**
- **547 HP B&W Sterling water tube boiler 225# pres. built 1938.**

DIESEL GENERATOR UNITS

3 phase, 60 cycle

1250 KVA (3) Elliott 2300/4160 volts, 720 RPM connected to G.M. Model 16-278A engines. NEW.

1000 KVA G.E. 2400 volts, generator connected to Enterprise engine.

937½ KVA G.E. 2400 volts generator connected General Motors engine.

750 KVA G.E. 2400 volts, generator connected to Enterprise engine.

500 KVA Allis 2300 volts, 225 RPM connected to Nordberg Engine.

375 KVA F.M. 2300 volts, 300 RPM.

375 KVA E.M. 480 volts, 600 RPM generator connected Buckeye engine.

250 KVA (2) Westghse. 220/440 volts connected to Buckeye engine.

185 KVA F.M. 2300 volts, 300 RPM connected Fairbanks 32-E-14 engine 1948, reconditioned, guaranteed.

20 KW Louis Allis, 125 volts D.C. generator connected 64 HP Hill engine.

DIRECT CURRENT UNITS

540 KW Westghse. non-condensing turbine 250 volts D.C. NEW, 200# PSI.

400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.

300 KW Westghse. 3-wire, 250 volts 150/250# PSI noncond. turbine.

100 KW G.E. 120 volts condensing or non-condensing geared 200-275 PSI.

60 KW (6) Elliott 125 volts condensing or non-condensing 200-250 PSI.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND 14, OHIO • CH. 1-0210

CHICAGO Electric Digest

PUBLISHED BY CHICAGO ELECTRIC CO. • THE HOME OF GUARANTEED REBUILT POWER EQUIPMENT

EQUIPMENT REBUILDING AT ITS FINEST!

SQUIRREL CAGE

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*220 volts or higher)

HP	Make	Type	Speed
1750	*G. E	K	3600
1000	*G. E	K6347S	1800
750	*A. C	TEFC	1800
750	*G. E.	KT	720
700	G E.	FT	3600
500	*G. E.	PBG	3600
500	*A. C.	6316SW	1800
450	*G E.	KF567S	1200
400	*Westgh.	CS	1800
400	*G. E.	KTP562	1800
400	A C.	ANW	900
400	*G. E.	IK	514
350	*Cr-Wh BBDP	SC	3600
300	*Westgh.	CS	3600
250	*L Allis	OGS	1800
250	*L. Allis	OGX148S	720
250	G. E.	IK	600
200	*G. E.	FT549Y	3600
200	*G. E.	IK13B	1800
200	A C	ARWWT	600
200	G E.	IK-17	600
150	*A. C.	AN	1800
150	G. E.	IE-K	1800
150	*G. E.	IK	600
150	A. C.	AR	325
125	Westgh	CS504S	3600
125	*A. C.	AR226	1800
125	G. E.	IK	1200
100	*G. E	FT542Z	1800
100	Westgh.	CS	1800
100	A. C.	AW	1200
100	G. E.	IK13A	1200
100	U. S.	CFU(Vert)	1200
100	*Westgh	CS(Vert)	1200
100	A. C	AN	900
100	G E.	IK15A	514
75	Westgh.	CS445S	3600
75	A. C.	AN	1800
75	Westgh	CS645C	1800
75	G E.	KT346	1200
75	G. E.	IK	1200
75	Westgh.	CS	900
75	*A C	AR(Vert)	900
75	A C.	AN	720
75	G. E.	IK	600
75	*Triumph	TR16	514
75	G. E.	IK	514
60	*Westgh.	CS504S	1800
60	A. C.	APZ445S	1800
60	A C	APZ504U	1200
60	G. E.	KT343	1200
60	A C	AR823	900
60	A C.	AR826F	514

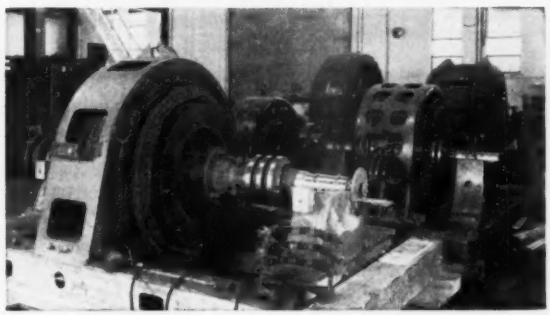
Hundreds of smaller motors!

AC SYNCHRONOUS

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	P.F.	Spd
2500	*A. C.		1.0	514
1420	*Westgh.		.7	900
720	*G. E.(25 cy)	ATI	1.0	750
700	*G. E.	TS975Z	1.0	1200
600	*G. E.	TS7640	1.0	900
600	*G. E.	ATI	1.0	240
400	Westgh.	HG	1.0	900
300	G. E.	ATI	.8	900
300	*G. E.	ATI	1.0	720
300	Ideal	SNS	1.0	257
190	Elc-Mch	2S	1.0	720
175	*Westgh.	HR	1.0	360
150	*Westgh.	HR	.8	900
125	G. E.	ATI	1.0	900
125	*Elc-Mch		1.0	900
125	Cr-Wh.	103S	1.0	900
125	*G. E.	TS	1.0	277
115	Elc-Mch	EM	1.0	240
100	Cr-Wh.	103S	.8	900
100	*G. E.	ATB	.8	900
100	Westgh		1.0	900
100	Ideal	SNS	1.0	900
100	G. E.	TS6184	1.0	450
40	G. E.	ATB	.8	1200
20	Fynn-W	15VRN		1200
15	Ideal			1800
15	Century	ARC365	1.0	1200
7½	Ideal			1800



SLIP RING

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

2000	*G. E.	MT-12	600
1500	*G. E.	MT30	240
1250	*Westgh	CW	600
1000	*Westgh	CS	250
700	*A. C.		720
500	*G. E.	IM	3600
500	*G. E.	MTP	1800
500	G E	IM	720
500	Westgh.	CW	350
400	A. C	3-brg	450
400	*G. E.	MT412	450
300	*G. E.	IM15A	1800
300	*G E.	MT410	450
250	Westgh.	HF15H	600
200	G. E	IM	1800
200	G. E.	IM15	1200
200	Westgh.	CW	600
150	Westgh.	CW772C	1200
150	*G. E.	IM16	600
125	*G. E.	MT549	1800
125	G. E.	IM15A	600
100	A. C.	ANY	900
100	G. E.	IM15A	450
75	Nwstrn.	HW50	1800
75	G. E.	MT347	1200
75	G. E.	MT356	900
75	G. E.	IM	900
75	G. E.	IM	720
75	G. E.	IM14	600
60	Westgh.	CW762C	900
50	G. E	IM11A	1800
50	*A. C.	ARY	1800
50	Westgh.	CW636A	1200
50	G. E	MT346	720
50	G. E.	IM14	450
40	*G. E.	MT532	1200
40	G. E.	MT336	1200
40	Westgh.	CW644	900
40	G. E	M504U	900
35	Fbks-M.	UAB(Vert)	1800
35	G. E.	IM	1200

TRANSFORMERS

KVA	Make	Phase	Pri.	Sec.
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
667	G. E.	1	33000	480
333	A. C.	1	14400	240/480
300	G. E.	3	13800	240/480
300	G. E.	3	2400	240/480
200	Wagner	1	2400	575
167	A. C.	1	2400	120/240
100	Pittsbgh.	1	2400	575
100	A. C.	1	2400	120/240

D. C. MOTORS

Mill Type—Pedestal Bearing Reversing

HP	Make	Volts	Speed
3000	Westgh (Tandem)	525	600
1750	Westgh	600	550
1500	Westgh	525	600
1200	Westgh	525	600
1000	Westgh	450	600

Mill Type—Non-reversing

HP	Make	Type	Speed
1500	Westgh (600v)		200/400
700	Westgh (600v)	MCF	150/525

230 Volts—Constant Speed

175	G E.	ELC	750
125	G. E.	Marine	1200
100	G. E.	RC34	2500
100	G. E.	RC19	575
75	G. E.	MDS106	485
60	G. E.	CD-115	860
50	G. E.	RC35	700
40	Cr-Wh.	CMC	1750
50	G. E.	CO2004	600
35	Cr-Wh.	CM351	700
30	G. E.	MD104½	725
30	Cr-Wh.	CCM	440
25	G. E.	CD93	1200
25	G. E.	RC32	800
25	Westgh.	SK100L	1100
25	Westgh.	SK133	575

Many others—1 HP and up
Also Variable-Speed and 115 Volts

AC SYNCHRONOUS

GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volt (*2200 volts or higher)

KVA	Make	Type	P.F.	Spd.
3500	*G. E.		.8	720
1750	*Westgh.		.7	900
1500	G. E.	ATI	.8	720
312	G. E.	ATI	.8	900
300	*G. E.	ATI	.8	720
225	G. E.	ATB	.8	600
187	Westgh.	ES	.8	720
112½	*G. E.	ATB	.8	1200
110	Cr-Wh.	103	.8	900
100	*G. E.	ATB	.8	900
60	Fbks-M.	B	.8	900
55	G. E.	ATB	.8	1200
50	G. E.	ATB	.8	1200
50	Westgh.		.8	1200
50	G. E.	ATB	.8	900

Phone: CAnal 6-2900

CHICAGO Electric Co.

1320 West Cermak Road, Chicago 8, Ill.

CHICAGO ELECTRIC does a thorough rebuilding job. Another example of this is shown in the photo at the left . . . a 1000 H.P. Slip Ring Mill Motor. The illustration shows the motor stripped down preparatory to rewinding. Skill, quality materials and pride of workmanship go into every Chicago Electric job. . . . Equipment rebuilding at its finest.

In addition to this outstanding rebuilding and repair service, Chicago Electric maintains one of the nation's largest stocks of guaranteed rebuilt power equipment. Whatever you need in the line of AC & DC MOTORS, M. G. SETS, GENERATORS, CONVERTERS, COMPRESSORS, HOISTS and other allied equipment you'll be sure to find it at CHICAGO ELECTRIC.

M. G. SETS

KW	Make	AC	DC
2400	A C.(3-unit)	4800	525
2400	Westgh. "	4800	600
1000	G E. "	11000	137½/275
1000	Westgh. "	11000	137½/275
500	A. C.-West.	2300	250
500	Cr-Wh.	220/440	250
450	G. E. (3-unit)	2300	125/250
400	A. C.	2300	120/240
250	West.-G. E.	440	250
200	Ridgeway	2200	250
150	G. E.	2300/440	250
150	G. E.	2300/4000	125/250
150	G. E.	440	275
100	G. E. (25 cy)	440	125
100	G. E.	2300	250
100	Delco-G. E.	440	120/240
90	G. E.	440	60
75	A. C.	440	250
60	A. C.	2300	110
60	G. E.	440	250
40	Cr-Wh.	220	125
40	A. C.	220	125
40	G. E.	220	125
35	G. E.	440	125
25	Westgh.	2200	125
25	G. E.	220	275
20	G. E.	440	250
20	Bogne-GE	440/550	250
20	Bogne-GE	220/440	250
20	Bogue-GE	220/440	125

DC to AC

100	G. E.	230	235
75	Westgh.	2300	110
12½	Westgh.	240	115

IF THE EQUIPMENT YOU NEED ISN'T LISTED — WIRE, WRITE OR PHONE FOR FURTHER STOCK INFORMATION

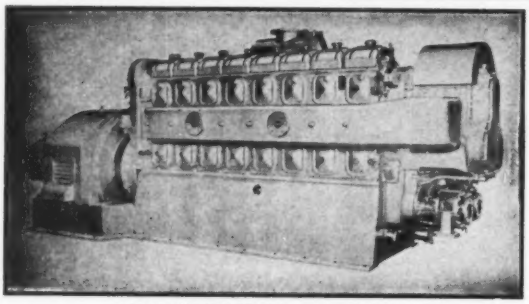
AIR COMPRESSORS

Size	Make	Type	Psi.	Disp.
12x11	Worth.	HB	100	426
10x11	Worth.	HB	100	294
9x9	Worth.	HB	100	211
8½x9	Worth.	HB	100	170
7x7	Worth.	HB	100	122
	Worth.	M-50	80-125	284
	Worth.	M-25	80-125	142
7½ HP	Worth.	AT833	100	35
10 HP	Worth.	AU933	100	48.8
5 HP	Worth.	3-TT	100	25.3
3 HP	Worth.	AS-8	100	17
2 HP	Worth.	2-TT	100	10.7
2½x2½	Quincy		150	5

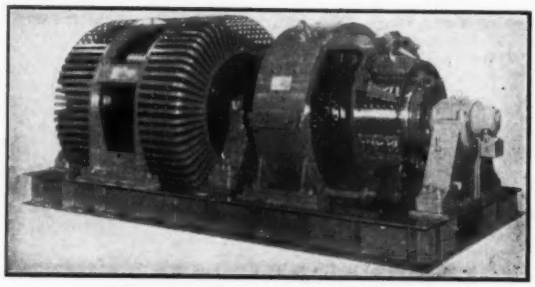
"THE O'BRIEN STORY"

KNOWLEDGE . . . FACILITIES . . . CAPITAL . . . EXPERIENCE . . . these are the requisites around which The O'Brien Story is built. With over 37 years of experience and know how in Manufacturing, Rebuilding, Reconditioning and Distributing Industrial Machinery of all types The O'Brien Machinery Company has expanded until today we are, in addition to being Philadelphia's leading Machinery dealers and exporters, one of the nation's outstanding Machinery houses. Our facilities consist of over 100,000 sq. ft. of fully equipped shops and warehousing space manned by our complete staff of graduate mechanical and electrical engineers, competent buying and selling personnel, trained electricians and skilled machinists. Our representation is both national and international, and our service facilities are linked from coast to coast. The name O'Brien in the machinery industry stands for quality and integrity which is the keynote of our success. "Know the integrity of your dealer and you will know the quality of your machinery."

Read More About "The O'Brien Story," in the next Issue of Power.



375 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1500 KW G.E. 250 Volt 3/60/2300/360 RPM
1—1000 KW West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #813047 (year 1935) See actual photo above.
1—500 KW Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/60/2300 V. A.C. & D.C. Panels.
1—300 KW West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
200 KW Elliott 250 Volt 1200 RPM 3/60/ Any Voltage.
2—150 KW G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels
100 KW Electro Dynamic 200 V. 3/60/220/ 1200 B. Brg. Sq. Cg. Sep. Excited.
1—100 KW Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 KW G.E.—C.D.—125 Volt D.C. 150 HP GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 KW Burke 250 V. 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/ 1200 RPM.
Smaller Sizes and Types—Advise Requirements

1—New O'Brien "Red-Line" 750 KVA OISC Transformer 13,200/13,800 v. pri., 480 v., sec., 3 ph.
3—333 KVA New O'Brien Red Line O.I.S.C. Transformers 4160 V primary 480 V secondary ea. single phase 60 cyc.

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	1000	GE	13200	2300	1
1	1000	Penna.	13200	480	1
1	1100	West.	4160	440	3
3	750	West.	2300	230	1
3	500	GE	13200	2300	1
3	333	(New)	2400	480	1
3	333	GE	13200	2300	1
3	250	West.	12200	2300	1
3	200	GE	7200	120/240	1

OISC TRANSFORMERS (Con't)

3	200	GE	13200	2300	1
3	200	Mal.	2300	220/440	1
3	200	GE	13200	2300	1
3	200	GE	7200	2300	1
3	150	GE	33000	220/440	1
3	150	Niag.	2400	240/480	1
3	100	West.	11000	480	1
3	100	GE	7200	120/240	1
2	100	GE	2300	115/230	1
3	75	Mal.	2300	115/230	1

DIESEL & GASOLINE GENERATOR SETS

1—1250 KVA Nordberg 3/60/2300/360 RPM 1940
6—875 KVA G.E.—Busch Sultzer 3/60/2300/ 275 RPM, Complete Plant, 1940
1—375 KVA GM 8-268A, 3/60/480/1200 RPM
1—250 KVA G.M. Twin 6-71, 3/60/220/440/ 1200 RPM Rad. Cooled.
1—187 KVA G.M. Twin 6-71 Portable, 3/60/ 220/440 New
1—125 KVA Hercules. 3/60/220/440/1500 Hrs.
1—56 KVA Climax Gasoline, 3/60/220/1200.
2—45 KVA Chry. New 6 Cyl. 3/60/220/440.
1—200 KW G.M. Twin 6-71, 240 D.C. Rad. Cooled Elec. Start.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1000	G.E.	K	2300	1800
1	1000	West.	CW	2300	450
1	600	West.	CS	2200	600
1	500	AC	ARX	2300	1800
1	500	West.	CS	6600/2300	514
1	450	A.C.	ANY	2300	600
2	400	G.E.	IK	2300	1800
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	250	G.E.	IM	2300	450
1	200	G.E.	IM	440	600
1	125	West.	Syn. 3 brg.	550	600

EXCEPTIONAL DELIVERY

New O'Brien mfrd. Red Line dry type Transformers to 150 KVA single phase, 300 KVA, 3 phase—4800 V. Pri—&. Phase Changers to 100 KVA.

ELECTRIC MOTORS (Con't)

2	100	G.E.	KT352	220/440	1200
2	100	G.E.	Syn.	440	300
1	100	G.E.	KT543	440	1800
1	50	West.	CS	440	3600
1	50	West.	CS	440	1200

TURBO GENERATORS

1—1250 KVA DeLaval Non-Cond. 3/60/2300. New 1940 240 psi 50 lb. B.P.
1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
1—200 KVA Moore Non-Condensing 3/60/480, 195 PSI, 100° F, 100# BP. Year 1936.
1—187 KVA West. Non-Cond. New 1930 3/ 60/440 110 psi 10 lb. B.P.
1—94 KVA Worthington Non-Cond. 3/60/220 140 psi 5 lb. B.P.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

PLATING, ANODIZING SET

1250 amps 15 V. 900 rpm Columbia 30 HP Sq. Cage Motor 3/60/220 Direct Drive Complete on base with DC Panel.

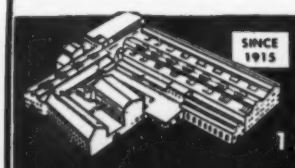
AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—1600 CFM Sullivan WJ 8 Angle Cpd. 100 psi 22/13x16 belt.
1—978 CFM Sullivan 13x13x8, 45 psi.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—868 CFM Sullivan 17x10x12, 100 psi.
1—528 CFM Ing. Rand 14x12, 100 psi.
1—215 CFM Penna 3A, 70 psi—V-Belt
1—368 CFM Chi. NSB, 12x10, 100 psi.
1—371 CFM Schramm 7⅛x5x4, 100 psi

BOILERS

1—390 HP Springfield 300 lbs.
2—363 HP Springfield 250 lbs.
2—300 HP Riley P. O. 250 lbs.
1—150 HP Keller C.P. 160 lbs.
1— 60 HP Ames Package 125 lbs.
1— 60 HP Ames Package 125 psi, 1947.

"Everything from a Pulley to a Powerhouse"



SINCE 1915

THE O'BRIEN MACHINERY CO.

T.M. REGISTERED U.S. PATENT OFFICE

PHILADELPHIA'S LEADING MACHINERY DEALERS & EXPORTERS

1547 N. DELAWARE AVE., PHILADELPHIA 25, PA.

• Telephone GArfield 6-1150 • Cable Address O BRIEN PHILA.

N.I.S.O.

AFFILIATED WITH SOC EXPANSO INDUSTRIAL SOL AMERICANA LTDA RIO DE JANEIRO—BRASIL

WORLD'S LARGEST INVENTORY

Established 1934

D & B Rated

APRIL BULLETIN

TRANSFORMERS—WORLD'S LARGEST INVENTORY

All Single Phase Unless Otherwise Noted.

KVA		PV	SV
1—6000	3 ph.	24000	5040/4800
1—3750	3 ph.	22000	600
1—3750	3 ph.	22000	440
1—3000	3 ph.	22000	440
1—3000	3 ph.	22000	480
3—2500		27600	2300
4—1000	3 ph.	13800	600
3—1000	3 ph.	13800	480
3—1000		13800	230/460
1—1000	3 ph.	2200	220 Delta
3— 833		2300	575
2— 833		13800	460
3— 800		22000	2200
4— 750		2200	244/488
3— 667		13200	2300
1— 667		13200	480
3— 667		6600	2300
1— 500	3 ph.	4000 WYE	460 delta
1— 500		4600	460
2— 500		11000	2300
3— 500		11400	40/80
3— 500		13800	460
6— 500		33000	6600/2300
1— 450		11000	230
1— 450		11000	460
3— 450		23000	445
3— 400		2200	244/488
2— 400	3 ph.	2300	230
5— 333		22000	2400
2— 333		11500	115/230
3— 333		2400	240/480
3— 333		2400	120/240

3—1250 KVA, G.E. transformers, 11,000 Pr. V. with 4 taps on 33,000, 2200 Sec. V., 25 cy. 1 ph. (O.K. for 60 cycle). Ser. 2,297,476-7-8.

PARTIAL LIST—2000 UNITS IN STOCK
FROM ONE TO 333 KVA
ALSO
AIR COOLED AND SWITCH GEAR

AC GENERATORS—ALTERNATORS—CONDENSERS

Quan.	KVA	HP	RPM	Cycle
2		2500	720	60
1		1675	600	40
2		1500	900	60
1		1500	1200	60
1		1430	514	60
3		1250	720	60
1		1250	1200	60
2		1000	600	60
1		1000	750	60
1		1000	750	25
1		800	900	60
1		720	900	60
2		650	139	60
1		500	720	60
1		412	225	60
1		400	450	60
3		400	1800	60
1		375	750	25
2		375	1200	60
1		350	720	60
1		300	750	25
1		312	1200	60
1		300	180	60
1		280	1200	60
1		250	900	60

Plus 78 smaller units from 3 KVA to 250 KVA

Cash for Your Surplus

SLIP RING MOTORS

Quan.	HP	Speed	Make
1	1200	237	Cr. Wh.
1	600	1800	G. E.
1	500	1800	G. E.
1	400	514	G. E.
1	400	435	West.
1	300	500	G. E.
1	300	450	G. E.
2	250	600	G. E.
1	250	480	G. E.
2	200	600	G. E.
3	200	450	Burke
3	150	720	G. E.
1	150	450	G. E.
1	125	435	G. E.
6	100	450	G. E.
1	100	900	G. E.

Plus 837 smaller units 1 HP to 75 HP

"There now, Sonny, are you satisfied that the propeller beanie really works?"

SQUIRREL CAGE—60 CYCLE

HP	Speed	Make
500 (3)	514	West.
450	720	G. E.
400 (2)	514	West.
300	600	West.
250 (2)	3600	G. E.
250	1200	Al. Ch.
250 (6)	900	West.
250 (2)	720	Open
200 (2)	1800	West. TEFC
200 (3)	1800	Wag., Rel.
200	1800	G. E.
200	600	Al. Ch.
150	900	G. E.
150	400	G. E.
125 (5)	1800	Al. Ch.
100 (2)	1800	West.

P.S. We stock 3500 new and rebuilt 1 HP to 100 HP

MOTOR GENERATOR SETS AC — DC

Quan.	KW	Make	Volts
1	1500	G. E.	300
2	1000	G. E.	600
1	1000	G. E.	250
1	1000	West.	250
1	750	Al. Ch.	275
1	600	G. E.	250
1	500	West.	125
3	500	West.	250
2	500	G. E.	250/275
1	500	G. E.	275
1	400	West.	125/250
1	400	West.	500
1	325	G. E.	500
2	300	West.	275
1	300	West.	550
2	200	West.	600
1	200	West.	250
1	170	G. E.	125
1	150	West.	125/250

Plus 238 sets from 1 KW to 150 KW in stock.

DC—ADJ. SPEED—230 V.

Quan.	HP	Make	Speed
1	3600	Dynam.	800/2000
1	650	G. E.	750/2000
1	300	G. E.	400/ 800
1	250	West.	250/ 675
4	250	West.	540/3000
1	125/190	G. E.	260/ 400
1	150	West.	320/ 580
1	150	Rel.	400/1200
1	100/150	West.	500/ 750
1	100	G. E.	1050/4000
2	100	Rel.	575/1150
2	100	West.	450/1000
1	60	El. Dyn.	525/1050
2	30/71	West.	450/1000
1	50/60	G. E.	220/1000
2	50	Diehl	400/ 800
1	25/50	G. E.	300/1200
1	35	G. E.	250/1000
1	30	West.	500/1000
1	30	West.	700/1750
1	30	Rel. TEFC	400/1200
3	25	G. E.	500/1500

Plus 327 smaller units 1 HP to 25 HP

CONSTANT SPEED—230 V.

HP or KW	Make	Speed
500 KW (2)	West. 125/250 V.	900
400 HP	El. Dyn.	1500
400 HP	G. E.	450
360 KW	G. E. 180 V.	1300
300 KW	West. 125/250 V.	1200
300 KW	G. E. 170 V.	1200
250 KW	Al. Ch.	750
150 KW	West. 125/250 V.	750
150 KW	G. E.	1200
150 HP	West.	1615/1785
125 HP	Star	1200
120 KW (2)	G. E.	1250

Plus 675 smaller units 1 HP to 120 HP also 115 V. & 550 V. DC.

ELECTRIC EQUIPMENT COMPANY

PHONE LD65

ROCHESTER, N. Y.

New and Rebuilt MOTORS MG SETS TRANSFORMERS CONTROLS COMPRESSORS 1 H. P. to 2500 H. P.

There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

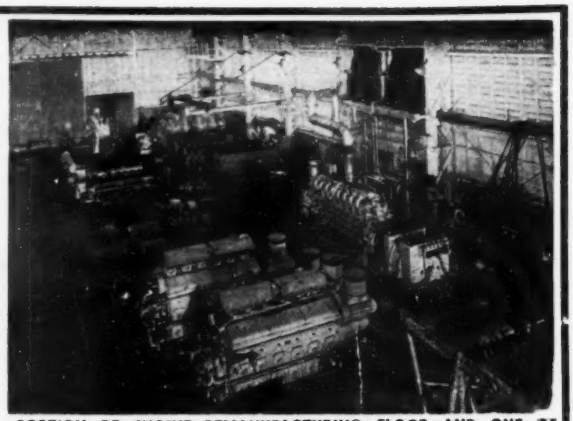
America's largest source of New and Remanufactured Diesel Power

A.G.

SCHOONMAKER CO., INC.

50 CHURCH ST., NEW YORK 7, N. Y.

PLANTS AND WAREHOUSES:
JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA
TELEPHONE — DIGBY 9-4350 • TELETYPE — NY 1-2804
W. U. WIRE • CABLE — AGSCOMACH



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1980	Nordberg	TS-217	3000	225
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	Baldwin	VO-8	750	514
500	Alco	6-12½x13T	750	600
500	General Motors	8-567	720	720
400	Ingersoll-Rand	S-8	600	720
350	Baldwin	VO-6	510	450
320	Enterprise	DSG-6	460	450
250	Fairbanks Morse	33-D	375	360
300	General Motors	8-268A	450	1200
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
150	Worthington	CC-4	225	450
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
100	Fairbanks Morse	38E	150	1200
60	General Motors	6-71	90	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

ELECTRICAL EQUIPMENT

REBUILT N.I.S.A. STANDARDS

AC Motors—3 phase 60 cycle

HP	Speed	Make	Wdg.	Type & Disc.
200	1800	GE	SC	K6333S TEFC
200	600	GE	SR 2200 V.	IM-3 Brg.
150	1800	GE	SR	M-6328 TEFC
150	720	Allis-Chal.	SR	AR-Hoist
125	3600	Elliott	SC 2200 V.	9NS62
125	600	GE	Syn.	TS-DC Exciter
100	1800	GE	SR	IM
100	725	Allis-Chal.	SR (25 cy.)	ARY-3 Brg.
100	900	GE	Syn. 2200 V.	TS-DC Exciter
100(2)	1200	GE	SC	I-K
75	1200	Wagner	SC	24-V
75	900	AC	SC	AR-BB
75	600	GE	SR	IM
75	600	GE	SC 2200 V.	KT-558
60	1200	GE	SC	I-K
60(2)	3600	GE & W	SC	K&CS 444SB
60(3)	1200	Allis-Chal.	SR	ARY-505 BB
60	900	AC	SC 2200 V.	ARZ-TEFC
50	1800	GE	SC	IK
50	1800	FM	SR	HV-BB
50	1200	GE	SR	MT-336
50	900	GE	SC	IK
50	720	CW	SC	SC
50	600	CW	SB	SB
40	3600	GE	SC	K-405s Exp. Pr.
40	1800	GE	SC	KT
40(2)	1200	Rel. & West.	SC	Fr 445-BB
40(2)	1200	FM	SR	HV-BB
40(2)	1200	AC&Rel	SC	TEFC-BB
40	900	West.	SB	CW
30(3)	1800	AC	SC	ARZ TEFC
30	1200	AC	SC	ARZ TEFC
30	1200	CW	SC	SC-BB
25	1200	Howell	SC	KBB-405 TEFC

SPECIALS

3—150 KVA Transformers GE Type H Form KD 1/60 33000 V. pri-2300/6900/11950Y. 2—150 KW West. M-G Sets 275 V. DC 3/60/3300 AC. 2—56RZ Falk Motoreducers 125 RPM 50 HP Class II. Hundreds other motors and electrical Items in stock. Large stock new motors to 150 hp & Gearheads to 30 hp at rated discount—Freight allowed. SEND US YOUR INQUIRIES.

NATIONAL ELECTRIC SERVICE CO.

735 So. 4th St., St. Louis 2, Mo. **Phone — Chestnut 4603**

BOILER FEED PUMPS

1—Lecourtenay 675 G.P.M., Type 4M 8B, 5 stage, 1100 Ft. Hd.
1—Worth. 740 G.P.M., type WCS-2, 5", 2250 Ft. Hd.
1—Worth. 700 G.P.M., type UNS-1, 6 stage, 6". 1550 Ft. Hd.
2—I. R. 200 G.P.M., 2", 1375 Ft. Hd.
Pumps above are mounted on basis for motor or turbine drive.

We have about 200 various size cent. pumps on hand, turbine, motor, and gasoline driven. Send us your inq.

DALTON SUPPLY CO.
2829 Cedar St. Phila. 34, Pa.

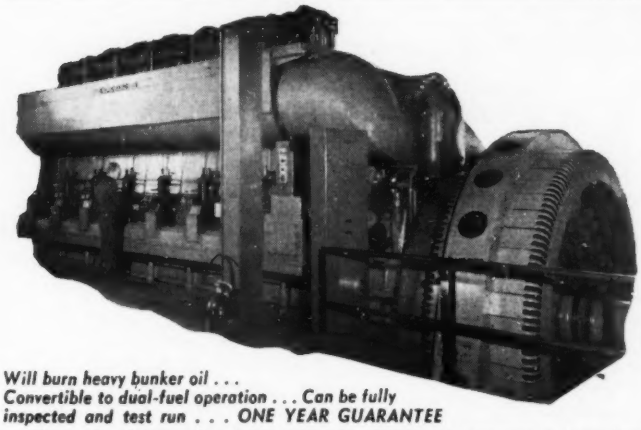
MODERN AIR COMPRESSORS

1721 FT. INGERSOLL RAND PRE-2—2200 V.
1302 FT. SULLIVAN WN-31—220/440 V.
1302 FT. INGERSOLL RAND Pre-2—2200 V.
676 FT. WORTHINGTON 125 H.P. 220/440 V.
800 FT. INGERSOLL RAND XPV-R Steam
315 FT. INGERSOLL RAND 75 H.—440 V.
DARIEN, 60 E. 42nd St., N. Y. 17, N. Y.

CURRENT MODEL · · DIESEL

1980 KW NORDBERG MODEL TS-217 DIESEL UNIT

Heavy Duty • Slow Speed • Available Immediately



Will burn heavy bunker oil . . .
Convertible to dual-fuel operation . . . Can be fully inspected and test run . . . ONE YEAR GUARANTEE

ENGINE: (2800 BHP net) Nordberg, 7 cylinder, 2 cycle Diesel engine at 225 RPM, 21¾" bore, 29" stroke, cylinders arranged vertical in line, solid injection.

GENERATOR: 1980 KW, 2475 KVA General Electric generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 225 RPM.

(50 cycle rating 1650 KW at 187 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust muffler, lubricating oil cooler, Young evaporative type cooler for jacket water cooling, thermostatic control valve, fuel oil day tank with transfer pump and oil meter, 2 lubricating oil storage tanks, lubricating oil transfer pump, Diesel-driven air starting unit, air tanks, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake, exhaust, water, lubricating oil, fuel oil, and air. Generator and exciter control switchgear.

The unit above affords a rare opportunity to procure a complete, modern, current model, heavy-duty, slow speed diesel set at a great saving. It represents an offering which cannot be duplicated anywhere in the diesel market today.

Act now . . . Phone, Wire, or Write for Full Details

ALL OWNED AND OFFERED EXCLUSIVELY BY

TELEPHONE
DIGBY 9-4350

TELETYPE
NY 1-2804

A.G.

"America's Largest Source of New and Remanufactured Diesel Power"

SCHOONMAKER CO., INC.

Western Union — WUX —
A. G. Schoonmaker Co. Inc., N. Y.
CABLE:—AGSCOMACH

50 CHURCH ST., NEW YORK 7, N. Y.

Plants and Warehouses: Jersey City, N. J. and Sausalito (S.F.), California

SUPERIOR DIESEL GENERATOR SETS

100 KW

30 sets available. ENGINE: 8 cylinder, 150 H.P.—5½ x 7. GENERATOR: 120/240 volts D.C., 417 amps., stabilized shunt, electric starting.

WRITE — WIRE — PHONE

THE BOSTON METALS CO.

313 E. Baltimore Street
Baltimore 2, Md.
Curtis 5050

A FEW OF OUR *SPECIALS*

TURBO UNITS, Non-Condensing

1560 KVA GE 480 v. 150/200 lbs & 15 lbs. bp.
937 KVA GE 480/240 v. 150/200# & 0/15# bp
375 KVA Al. Chal. 240/480 v. 135/150# & 0/25# bp
125 KVA GE 240/480 v. 135/200# & 0/25# bp

BOILERS

1—820 HP (2) G.E. Sterling 300#
3—45000# B\' 275# Integral furnace F19. "1937"
2—30000# Combustion 2 drum, package type 250# "1949"
1—309 HP Combustion 3 drum, 160# "1940"
1—256 HP Combustion 150#, semi-portable, "1950"
2—255 HP Combustion, 200# 3 drum. "1937"
1—125 HP Erie City, 200# self contained "1947"

DIESEL UNITS

1420 KVA (2) F.M. opposed piston 720 RPM
1000 KVA Elliott-DeLaVergne 200 RPM
483 KVA (2) GE-Winton (GM) 360 RPM
300 KVA F.M. 277 RPM
220 KVA (2) Wghse.-Buckeye 7 cyl. 400 RPM
187 KVA E.N.-Buckeye 5 cyl. 514 RPM
150 KVA FM Model 32-257 RPM
100 KVA General Motors 200 RPM
50 KVA GE-Caterpillar 900 RPM
37 KVA General Motors 1200 RPM

STEAM ENGINE UNITS, A.C.

375 KVA (2) Wghse—Skinner Uniflow
187 KVA Wghse.-Ames Uniflow (vertical)
150 KVA GE-Skinner Uniflow
75 KVA GE-Ames Uniflow

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St. New York, N. Y.

TURBO-GENERATORS
IN STOCK

TAMPA ARMATURE WORKS — TAW — "Industry's Friend"

CONDENSING

1—625 KVA 5000 KW 3600 RPM Allis Chalmers 200 lbs. 100° SH. Will operate 275 lbs. 6150 TT without change. Generator 3/60/11500. Can be changed to 2400/4160. Complete auxiliaries. Can be operated for inspection. Checked by factory engineer in Sept. 1951—no repairs required.
1—1567 KVA 1250 kw 3600 RPM Allis-Chalmers 150 lbs. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.
1—1250 KVA 1000 kw 3600 RPM Westinghouse 185 lbs. 100° SH 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.
1—937 KVA 750 kw 3600 RPM Gen. Elec. 150 lbs. Generator 3/60/2300.

NON-CONDENSING

1—1250 KVA 100 KW 3600 rpm General Electric 140 lbs. turbine with type ATB Form T 3/60/2300, 80 pf, Synchronous Generator.
1—625 KVA 500 kw 3600 rpm General Electric 175 lbs. Single stage turbine with type ATB form T 3/60/2300, 8 pt. Synchronous Generator.
1—187½ KVA 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH. Generator 3/60/240.
1—125 KVA 100 kw Westinghouse geared 7200/900 rpm 150 lbs. 3/60/240.

10,000 KVA TRANSFORMER
BANK OF 3-3333 1 Ph. 60 Cy.
66000 to 33000 & 13200 VOLTS

1800 KVA 3 Ph. TRANSFORMER
6600 to 440 VOLTS 60 Cy.
READY TO SHIP

OTHER TRANSFORMERS
1 PH. 60 CY.

2—1000 KVA 13800/2300 V.
3— 200 KVA 33000-2300/4600 V.
7— 100 KVA 33000—2300/4600 V.
3— 75 KVA 2400-240/480 V.
40— 10 KVA 2400-120/240 V.

DIESEL GENERATOR

250 KW Superior YLO 350 HP
400 RPM 3/60/2200-440 or 220

OUTDOOR
OIL CIRCUIT BREAKERS

1— 600 A. 110 KV GE FK0136
1— 400 A. 73 KV West. G-1
3— 400 A. 37 KV GE FK0136
1— 400 A. 37 KV West. 0221
1—1200 A. 15 KV GE FHK0236
1— 600 A. 15 KV West. 0221
1— 600 A. 15 KV Condit 0-1

OUTDOOR
POTENTIAL TRANSFORMERS

13—33000/110 V. 200 V—A GE E116
3—33000/110 V. Westinghouse

INDOOR
OIL CIRCUIT BREAKERS

1—2000 A. 15 KV 500 MKVA West. CO-11
9—1200 A. 15 KV 500 MKVA West. CO-11
1—1200 A. 15 KV 150 MKVA West. B20B
1— 800 A. 15 KV 130 MKVA West. B20
12— 400 A. 15 KV 130 MKVA West. B-20
1—2000 A. 4500 V. GE K-34

TAMPA ARMATURE WORKS INC.
401 S.MORGAN ST. TAMPA, FLORIDA PHONE 2-1966

STEAM TURBINE GENERATOR UNITS
3 Phase, 60 Cycle

2,500 KVA Westinghouse condensing, 200/400 lbs. steam pressure, 700° FTT, 2400 volts, with surface condenser.
1,250 KVA Allis Chalmers condensing extraction, 250 lbs. steam pressure, 600° FTT, 25 lbs., extraction, 480 volts with surface condenser.

UNIFLOW GENERATOR UNIT
3 Phase, 60 Cycle

750 KVA Allis generator, 240/480/600/2300/4160 volts, 277 RPM direct connected to Ames vertical uniflow steam engine, 160-225# pressure, 5# exhaust.

BOILERS

60,000# steam per hour (2) Foster Wheeler, package type marine, 435# pressure. Oil fired.
30,000# steam per hour (2) Combustion Engineering, package type, 250# pressure. Oil fired.

GENERATORS
3 Phase, 60/240 Cycle

2500 KVA G.E. 60 cycle, 2400/480 volts, 3600 RPM.
2859 KVA (3) G.E. 240 cycle, 4160 volts, 4800 RPM.
4600 KVA G.E. 90 cycle, 2400 volts, 5400 RPM.

GASOLINE GENERATOR UNIT
3 Phase, 60 Cycle

75 KVA G.E. generator, 2300/480/240 volts, 1200 RPM direct connected to 100 HP Winton gasoline engine.

INTERNATIONAL POWER MACHINERY COMPANY
Union Commerce Bldg., Cleveland 14, Ohio
Telephone: MAin 1-9514

NOW LIQUIDATING
Equipment from Closed Brewery
Marion, Indiana

1—Carbondale 10x10 Vert. twin cylinder Ammonia Compressor, 82 ton, 75 HP motor.
1—Taber Fermentation Gas Collector with 8 storage tanks 50 cu. ft., ASME 245# WP.
5—Niagara Spray Cooler and Fan Cooler Units.
1—Rotary Pump 5", with 40 HP motor, 1000 GP —86' Hd.
Lot of Welded Steel Storage Tanks (closed) 5500 gal., 10,500 gal., 11,300 gal. and 12,700 gal.
Lot of Welded Steel Tanks, 16'10" L x 7'7" W x 8'9" deep, open top, flat bottom.

FOR SALE FROM PHILA. STOCK

2—1-R Motorblowers, type FS-538; cap. 4000 CFM @ 3# Pr.
1—Penn Steam Booster Compresser 4x5
1—Terry Steam Turbine, 10 HP
1—Coppus Steam Turbine, 8 HP
1—Byron Jackson Bronze Deep Well Turbine Pump with 20 HP motor. 150 GPM.
1—1-R #5-ALV Bronze Centrifugal Pump with 40 HP motor. 850 GPM—140'.
1—1-R #1½-RVH Bronze Centrifugal Motorpump with 20 HP motor. 200 GPM—200'.

PERRY EQUIPMENT CORP.
1422 N. 6th St. PHILA. 22, PA.

Nordberg-G.E. 875 KW diesel generator set, 257 rpm, 2300 v., 1250 HP, complete.
Allis-C 625 KW turbo-generator set, cond., 440 v.
1500 KW McIntosh-Seymour-G.E. diesel-elec. gen. set.
3—Worthington, Buckeye diesel sets, 120-300 KW.
Locomotive cranes, Orton 40-ton, Ind.-BH 30-ton.
Locomotives, 7 to 80 tons, diesel, gas, steam.
Whirley portal gantry cranes, 25-50 tons.
H. Y. SMITH CO.
828 N. Broadway Milwaukee 2, Wis.

GENERATOR SETS
100 KW 200 KW

General Motors 3 Cylinder Diesel Engine Sets Model 3-268A, Direct Conn. to: 100 KW Westinghouse Alternators 3/60/440 Volts, Inc. Switchboards. Ready to ship.

ALSO — COMPLETELY REBUILT

General Motors 8 Cyl. Diesel engine, Model 8-268A, Direct conn. to 200 KW General Electric Alternator 3 Ph., 60 Cy., 440 Volts. Inc. Switchboard. Immediate shipment.
VARIOUS TYPES & SIZES IN STOCK
A.C. & D.C. GEN. SETS
ALJON ELECTRIC DIESEL CO.
904 Pacific St. Brooklyn 16, N. Y.
STerling 3-6515

DIESEL GENERATORS

1—200 KW, General Motors, Mod. 8-268-A 3/60/ volt/1200 R.P.M.
1—100 KW, General Motors, Mod. 3-268-A 3/60/ 450 volt/1200 R.P.M.
1—100 KW, General Motors, Mod. 3-268-A 120/240 volt D.C.—1200 R.P.M.
P. A. HENAULT
25167 Grand River Ave., Detroit 19, Mich.

STORAGE & PRESSURE TANKS
Located Mo.-Fla., N.J. & Conn.

8—12,000-17,000 & 20,000 Gal. 90 Lb.
16—10,000-15,000 & 20,000 Gal. Storage
9—42,000, 120,000 & 240,000 Gal. Stg.
LESTAN CORP., ROSEMONT, PA.

"Opportunity" Advertising:
Think
"SEARCHLIGHT"
First

COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

REFRIGERATION UNITS

TWO PRACTICALLY
NEW WORTHINGTON CARBONDALE
REFRIGERATION COMPRESSORS

300 Ton Freon

Ideal for large plant or office building

WILL SACRIFICE

WINSTON MACHINERY CO., INC.
326 WEST OHIO STREET
INDIANAPOLIS, INDIANA

FOR SALE
18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE
2457 WOODWARD AVE.
408 DONOVAN BLDG.
DETROIT 1, MICH.

FOR SALE
MODERN 1000 KW Turbo-Generator

in excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum. Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
6101 Tacony St. Philadelphia 24, Pa.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

2—1000 KW GE Mercury Arc Rectifiers
1—100-175-200-300 HP Slip Rg. Motors
1—40 HP Dutton 125# Package Boiler
1—100-400-600 KW Gens. w/Corl. Engs.
2—500/1000/1500 KW Rotary Converters
2—65'x100'x50' Steel Bldgs. w/Cranes
1—150 & 250 HP Self-Contained Boilers
H. & P., 6719 Etzel Ave., St. Louis 14, Mo.

RE-NU-BILT BELYEA MOTORS

THE TRADE MARK WITH A MEANING
SUCCESSFUL OPERATION GUARANTEED
*44th Year of Service—Member of A.R.A.**

A. C. MOTORS
3 ph. 60 Cycle

SYNCHRONOUS

Qu.	HP	Make	Type	Volts	Speed
1	5000	Whse.		2500/5000	600
1	4350	Cr Wh.		4160/13800	514
2	3500	G. E.	TS	2300	257
1	2500	G. E	ATI	2300	720
2	2100	G. E.	ATI	2300	360
2	2000	Whse.		2300	120
2	1750	G. E.	ATI	2300	3600
3	735	G. E	ATI	2200/12000	600
1	500	Ideal	BM	2300/4150	1800
1	450	Whse.	Eng.	2200	128.5
1	450	Whse.		2300	450
2	350	G. E.	TS	2200	180
1	300	Whse.		2300	720
1	150	Whse.		440	600

SLIP RING

1	1800	G. E	MT-498	2300	360
1	1500	ABB		2300	720
1	1200	G. E.	MF-26	2300	275
2	1000	A.C.	Mill	2300	240
1	500	Whse.	CW	500	360
2	500	G E unused	M-574Y	2200	900
1	500	G. E.	IM	440	900
1	400	Whse.	CW-1218	2200	435
1	400	Whse.	CW	440	514
1	350	G F.	MT-442Y	2300/4000	253
2	300	G. E	MT-565Y	2300	900
1	300	A C		410	514
1	300	A.C.		440	505
1	250	G E.	MT-424Y	4000	250
1	250	G E.	MT-559S	2200	1750
1	250	A C.		550	600
1	200	Cr. Wh.	26QB	440	505
1	200	G E	IM	410	435
1	200	G. E	MTP	410	1170
1	200	Whse.	CW	410	490
1	200	G. E.	IM	440	600
1	150 new	Whse.	CW	2300	450
1	150	G. E.	IM-16	440	600
2	125	A.C.		440	865
1	125	A. C		440	720
1	125	G. E.	MT-566Y	440/2200	435

SQUIRREL CAGE

2	650	G. E.	FT559BY	440	3750
2	450	Whse.	CS	2300/4150	354
1	200	G E.	IK-17	400	580
3	200	G. E.	KT557	410	1800
1	200	G E	KT-559Y	2300	1200
1	200	G. E.	IK	440	865
1	75/150	G. E	IK	440	450/900
1	150	Whse.	CS	440	580
1	150	Wstghse.	CS8568	410	830
1	125	Whse.	MS	440	485
1	125	G E.	KF-TEFC	440	3588
2	125	A.. Ch.	ARW	2200	1750

D.C. MOTORS

Qu.	H.P.	Make	Type	Volts	Speed
1	2200	G. E.	MCF	600	360/500
1	2000	Whse.	Mill	600	230/460
1	910	Whse.	QM R Brg.	250	140/170
1	900	Whse.		250	450/550
1	600	Al. Ch.	MILL	230	400/800
1	500	Whse.	Mill	600	300/900
2	450	Whse.		550	415
1	400	G. E.	MCF	550	300/1050
1	300/400	G. E.	DYNA	250	1325/2500
2	300	Whse.	CB-5094	230	575/1150
1	200/300	G. E.	MPC	230	360/920
1	250	G. E.	MPC	230	400/500
1	200	Rel.	1970T	280	720
1	200	Whse.	CB-5113	230	400/800
1	150	G. E.		600	250/750
10	150	Cr. Wh.	83H	230	890
1	150	Cr. Wh.	CMC-65H	230	1150
1	150	Whse.	SK-201	230	360/950
1	150	Whse.	SK-151 B	230	900/1800
1	150	Whse.	CB-2073	230	525/1150
1	50/120	G.E.	MFC	230	250/1000
2	100	Whse.	SK-181	230	450/1000
1	60	El. Dy.	25-S	230	525/1050
2	50/60	Whse.	SK-170	230	400/1200
1	50	G. E.	CO-1810	230	725
1	50	Whse.	SK-170	230	350/1050
2	50	G. E.	RCP-31B	230	1700

MOTOR GENERATOR SET
3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G. E.	514	600	13800/4000
2	2000*	G. E.	500	600	6600/11000
3	1500	G. E.	514	250	4000/13200
1	1500	G. E.	720	600	6600/13200
1	1500	G. E.	360	275	2300/4400
1	1500	G. E.	600	600	2300/4150
1	1500	C.W.	514	115	2300
1	1200	A.C.	720	550	2300
2	1000	Whse.	900	600	2300/4100
1	1000	G. E.	900	260	6600
1	1000(3U)	G.E.	900	250	2400/4800
2	750	Whse.	900	275	2300/4160
1	750	C.W.	514	115	2300
1	600	G. E.	720	250	440/2300
1	500	Whse.	900	125/250	440
1	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G. E.	720	125	2300/4000
1	400	G. E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	350	G. E.	900	125	2300/4150
1	150	G. E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G. E.	1175	125	440
1	140(3U)	Cr.-Wh.-	690	125/250	2300
1	125	G. E.	1200	125	440
1	100	Delco	1200	125/250	440

*25 Cycle

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1	3000	G. E.	25/60	4000/2300x2300/4000
1	2000	G. E.	25/62½	2300/4160
1	2000	Whse.	25/62½	2300/2300
1	1000	G. E.	25/58	4400/2300
1	500	A. C.	25/60	11000/2300V

TURBO GENERATORS

Qu	KW	Make	Desc.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300.
	1000	G. E.	Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
	750	G. E.	Condensing 425#-725*TT I.S.P. 440 V. 3 ph. 60 cy New — 1944
	750	Whse.	Non-condensing 135# I.S.P. 40# B.P. 750 Kw. 280 V. D.C.
	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter.
	500	G. E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
	400	Whse.	Non-condensing 125/150# I.S.P. 5/10# G.B.P., 240/480v. 3 ph. 60 cy.
	300	G. E.	Non-condensing 10/175# I.S.P. 5/15# B.P. 480V. 3 ph. 60 cy.
	200	Whse.	Non-condensing 150# I.S.P. 7# B.P. 240 V. 3 ph. 60 cy.

TRANSFORMERS
60 Cycles

Qu.	KVA	Make	Type	Ph	Voltages
1	2500	Whse.	OISC	3	26400/13200x460
3	2000	G. E.	HVDDJ	1	66000x13800#
3	1000	G. E.	H	1	2200x480
1	1500	G. E.	HT	3	13200x2300
3	1250	G. E.	H	1	6600x550
1	1150	A. C.	OISC	3	13200x2300/48(
2	1000	Pitts.	OISC	3	2300x460
1	500	Whse.	OISC	3	13400x216
4	300	G. E.	HT	3	2400x240/480
3	200	Whse.	OI5C	1	13200x120/240
3	150	Whse.	OISC	1	33000x2300/4000
3	100	G. E.	OISC	1	2400x120/240
2	75	Upte	OISC	3	4160x240
1	50	Mol.	Asherel	3	13200x120/208
3	10	G. E.	H	1	2300x115/230
9	7½	G. E.	H	1	2300x115/230

***American Rebuilders Association — Member Body of A.S.A.**

BELYEA COMPANY, INC.

OFFICE AND SHOP

43 HOWELL ST., JERSEY CITY 6, N. J.

PHONE JO 2-3334 — N. Y. CITY LINE RE 2-7150

GET MORE FOR YOUR MONEY FROM HEMPHILL GUARANTEED EQUIPMENT

GUARANTEED GOOD BECAUSE REBUILT AND TESTED BY HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph	Voltages
1	1500	G.E.	Pyranol	3	4150x2400
1	1000	G.E.	Auto	3	4150x2400
2	750	G.E.	HT	3	4150x120/240
1	500	Kuhl.	OISC	1	4150x2400
2	400	Pitts.	OISC	1	4800/4150/2400x240/480
3	333	Whse	OISC	1	2400x575
1	333	G.E.	H	1	13200x220/440
3	200	A.C.	CBS	1	13200x240/480
2	200	A.C.	CBS	1	480x120/240
3	200	Mol.	C	1	2300x220/440
1	200	G.E.	HT	3	2400x240
2	150	Pitts.	ODSC	1	240x120/240
3	150	G.E.	H	1	2400x120/240
3	100	G.E.	H	3	13750x125/216Y
3	50	G.E.	H	1	4800x120/240
3	25	G.E.	H	1	575x115/230
3	25	Ning.	OISC	1	2400x480
1	25	G.E.	H	1	440x110/220

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
1	1000	G.E.	514	600	2300/4150 Syn.
1	1000	Whse.	720	600	2300/4150 Syn.
1	1000	Whse.	720	275	2300/4150 Syn.
1	150	3 Unit G.E.	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	C.W.	1200	125	2300 S.C.
1	100	G.E.	900	250	2300 Syn.

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
3	200	Whse.	720		4150
1	175	G.E.	720	ATI	2300
1	150	G.E.	720	ATI	2300
1	150	G.E.	1800	TS	220
1	150	Whse.	900	181G	220
1	150	A.C.	360		440
1	125	El. Mach.	900		4800
1	100	G.E.	900		2200

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	400	Whse.	450	CW	550
1	250	Whse.	600	CW	440
1	200	Whse.	600	CW	440
1	200	G.E.	600	MT	440
3	150	A.C.	1800	AY RW	2300
1	100	G.E.	1800	IM	220
1	100	G.E.	600	IM	440
1	75	G.E.	600	IM	440
1	60	G.E.	1800	MT	220
1	60	G.E.	900	MT	440

SPECIAL M.G., A.C. WELDER

1—176 KVA Whse., 220 V. 57 PF, 1200 RPM, 1 ph., with 75 HP Slip Ring, 440 V, type CW, Exc. & Control w. flywheel.

SPECIAL WELDING

1—150 KVA GE, type KWC, 1 ph., 550 V, sec. 12.22/6.05 V, Thyratron Spot and Seam, Control CR 7503

Member of the National Industrial Service Assn., Inc.

"FOR POWER"

J. L. HEMPHILL & CO.

1604 53rd STREET NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3277

PHONE NEW JERSEY—UNION 3-2600

SLIP RING MOTORS
3 Phase, 60 Cycle

Qu.	HP	Make	Speed	Type	Voltage
4	3500	G.E.	120	IM	2300
1	200	Ideal	1200	Vert.	4000
1	200	G.E.	600	IM	220/440
1	200	Whse.	600	C.W.	220
1	200	G.E.	400	IM	440
1	150	Whse.	1200	HF	2200/4000
1	150	Whse.	900	CI	440
1	150	Whse.	720	C.W.	440
2	100	A-C	450	ANY	440
1	75	G.E.	900	MT	440
1	75	G.E.	720	IM	220
1	75	A-C	720	3-Bear.	220
1	70	Eng. El.	1200	DP BB	440
1	60	C-W	1800	SR-Vert.	220
1	50	G.E.	1200	IM	220
1	50	G.E.	900	MT	220/440
1	50	A-C	900		550
1	50	G.E.	600	IM	220
1	40	Whse.	900	C-W	220/440
1	30	G.E.	900	MT	220
1	30	G.E.	900	MT	2200

DIRECT CURRENT EQUIPMENT

Size	Make	Speed	Type	Voltage
325 KW	G.E.	500	MPC 3 Bear.	250
250 KW	G.E.	500	MPC 3 Bear.	250
150 HP	West. El.	1635	RC	230
150 HP	Diehl	250/400	K-15-10-3 Bear.	230
100 KW	G.E.	675	DLC	250
100 HP	Reliance	580	Open-SB	230
65 KW	Whse.	1175	SK-DP-BB	120
40 KW	Reliance	1150	DP BB	250
20 KW	Whse.	835	SK	230
25 HP(2)	Imperial	725	D	230
20 HP	Whse.	1150	SK	230

SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle

Qn.	HP	Make	Speed	Type	Voltage
2	200	A-C	900	ART Hi Torque	440
1	200	G.E.	600	IK	220/440
1	100	Wagner	1200	TEFC CI	220/440
6	100	El. Prod.	900	BB	2200
1	75	Whse.	600	CCL	220
1	75	E-M	514	IC	440
1	60	G.E.	1800	K	220/410
1	60	A-C	1200	AR	220/410
1	60	A-C	900	ARV Vert	440
1	60	G.E.	720	IK	440
1	50	A-C	900	open	220
1	50	G.E.	1800	KT	440
1	50	Master	1800	CFU Vert.	220/410
1	50	El. Dyn.	1800	KNX TEFC	220/440
1	50	El. Dyn.	1800	Open BB	220/440
1	50	G.E.	1800	K	220/440
1	40	U.S.	1800	SA	440
2	40	A-C	1200	AR	220/440
1	40	A-C	1200	TEFC X-PRF	220/440
1	40	F-M	900	Open BB	220
1	40	G.E.	720	KT	440

SYNCHRONOUS MOTORS
3 Phase, 60 Cycle

1	220	G.E.	720	ATI	440
1	125	G.E.	720	ATI	440
1	115	E-M	600		220
1	50	Ideal	1200	SM	220

DYNAMOMETER

1—60 oHP, Eddy Current type, 1000/4000 RPM, type 2025A, 250 volt. Mfg. by Mid-West.

WM. KECK'S SONS

Electric Motor & Engineering Service

201 N. Bluff Street — Joliet, Illinois

BOILERS

2—Babcock & Wilcox Stirling Boilers, Class H3, No. 17, 160 lb. pressure. Nominal rating B.H.P., 300 H.P. Complete with combustion engineering stoker, Type EHBA underfeed and all accessories. New in 1942.

1—Wagner Steam Pump Co. 08000, 7" x 5" x 10" Duplex Steam Pump. Serial No. 16471. New in 1947.

1—A.D.S. Co. horizontal steel storage heater, 48" x 144" overall. New in 1945.

1—Worthington Pump. 7½" x 4½" x 10" horizontal duplex piston type steam boiler feed pump.

1—horizontal belt coal conveyor, 40' section, 18", 4 ply rubber belt with drives 40' Coal conveyor.

1—Inclined belt conveyor, 36' section, 18".

1—Bailey Boiler Meter, Type D36, Class 1 No. 70705. New in 1940.

1—Conveyor belt, 156' of 18" x 4 ply Goodyear, Style "W".

1—Westinghouse 60 K.V.A. multiple dust tight, Type FP capacitator. New in 1945.

Call, write or wire—W. Boyd

TOTAL PRICE $10,000.00

THE RENNER BREWING CO.

275 North Forge St., Akron, Ohio

JE 2103

BOILERS—TURBINES—ENGINES and AIR COMPRESSORS

Boilers 50-2000 HP; Turbo Gen. 100-6000 KW; St. Eng. Gen. 75-1000 HP. Write for our Free New List of High Grade Used Equipment.

BENJAMIN W. BISSELL, Reg. Engineer

610 K of P Building, Indianapolis 4, Ind.

Phone Lincoln 4007

POWER EQUIPMENT

BOILERS

3—#587 Kewanees Comp. Plant, new 1946 150 HP ea. 100#

MERRILL and COMPANY

407 S. Dearborn St. Chicago 5, Ill.

Telephone HArrison 7-8289

VARIABLE SPEED DRIVES

FREQUENCY CHANGERS

LOW-VOLTAGE GENERATORS

American ELECTRIC CORPORATION

DEPT. P, Box 133, INDIANAPOLIS, IND.

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	1200	2300/440	Westgh., CS
300	900	440	G.E.
200	490	2200	G.E.,-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	2300/440	A-C, AR.
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
50	3600	220/440	G.E.-404S
50	1800	220	Triumph
50	720	2200	Westinghouse
40	1800	220/440	West.-444
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.

*New Motors

Special

FREQUENCY CHANGER

2500 KW General Electric
2300 volt, 3 phase, 25 cycle,
4000 volt, 3 phase, 60 cycle,
300 RPM.

4 SPEED MOTORS AND CONTROL

Century, Model SCNM504Y90IAV, 20 HP, 440 volt, 3 Phase, 60 Cycle, 1700/1120/870/560 RPM, Multi-speed, ball bearing. With plugging switch mounted on shaft; motors on adjustable hinge bases. Control —Allen Bradley, Magnetic.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
400	514	440	West.-Cw
375	1800	2300	Al. Ch.
350*	514	440	G.E., TE, FC, BB
300	514	440	Al. Ch. 3 Brg.
250	600	2200	G.E.-117B
250	450	2200	C.-W.
250	450	2200	G.E.-I-17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-IM
200	514	440	West.-CW
150	1800	2200	FM-HV
150	720	2200	Al. Ch.
150	600	220	Wagner
125	1750	2200	West., CW
120	900	550	Ideal
100	720	440	Al. Ch.
100	600	2200	G.E. MT-562
100	600	220	Wagner
100	400	440	West. Elec. (GE)

*New

MOTOR GENERATOR SETS

D.C. OUTPUT			A.C. INPUT		
KW	Voltage	Description	HP	RPM	Volts
1500	600	G.E., MCF	2100	720	13200
1200	525	Al. Ch.-G.E.	2000	720	2300
800	500	West., 3 unit	1200	1200	2300
800	250	Westgh.	1200	1200	2300
750	550	G.E.	1070	900	2300
750	500	Westgh.	1070	900	13200
750	250	Westgh.	1070	900	13200
600	250	Westgh. (2-300 KW Gen.)	1200	1200	2300
600	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.,-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	730	440
200	250	G.E.,-Westgh.	300	1200	440
100	250	Delco-Westgh.	150	1200	220
100	250	G.E.	150	1200	220/440
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
35	125	G.E.	50	1800	2200
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT				A.C. END		
AMPS	VOLTS	RPM	DESCR.	HP	VOLTS	DESCR.
4000	2 to 8	425	Jantz & Leist			
2400	40/80	1200	Westgh.	290	440	WH Sync.
1500/750	6/12	1200	Munning			GE—
			Loeb	15	440	I Cage
1200	60	1160	Century	108	220/440	Century, SCN-584
1000	60	1200	Century	100	440	Century Cage
1000	6	1200	Wagner	—	—	—
800	30	900	C-W	40	220	C-W type 122Q
680	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	6		GE Rect.	—	440	—
416	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hobart	25	220/440	Hobart
208	62	1800	G.E.	20	220/440	GE-KT

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

Glow Electric Company

927 HARRIET ST. CINCINNATI 3, OHIO PHONE MAIN 3024

N.I.S.A. NATIONAL-INDUSTRIAL SERVICE ASSOCIATION, INC.

FOR SALE

CARRIER REFRIGERATION

Used Centrifugal Refrigerating Machine, Model 17-M, size 42, applicable to all refrigeration and air conditioning requirements, maximum 240 tons, direct connected to Murray low pressure steam turbine. Can be used for various capacities and temperatures. Complete unit, excellent condition. Can be purchased at a saving of fifty percent of its new cost. CAN BE ARRANGED FOR MOTOR DRIVE.

DENNY & CLARK

1923 W. North Ave. Chicago 22, Ill.

EXISTING

BOILERS

10 to 5000 HP — 10 to 900 PSI

Diesel Engine — Steam Turbine

GENERATORS

DEAN G. STRICKLER & ASSOCIATES

5220 Pennington Ave. 1346 Conn. Ave.
Baltimore 25, Md. Washington 6, D.C.
Curtis 4434 DuPont 7-3386

TRANSFORMERS FOR SALE

Rebuilt and guaranteed for one (1) year.

Qu.	KVA	Make	Type	Ph.	Cy.	Voltage
2	25	GE	HN	1	60	6900/230/460
3	25	GE	HN	1	60	2300/4160/115/230
3	25	West.	SK	1	60	2300/4160/115/230
3	25	GE	H-KH	1	60	11500/230/460
2	25	Kuhlman	OISC	1	60	2300/4600/115/230
1	37½	GE	HN	1	60	6900/115/230
3	37½	GE	HK	1	60	2400/4160/240/480
2	30	GE	HK	1	25	2300/230/460
3	50	West.	SK	1	60	4160/240/480
1	50	GE	HT	3	60	4800/240/480
1	50	Subway GE	HKW	1	60	2400/120/240
3	50	Kuhl.	OISC	1	60	11000/120/240/480
2	50	West.	SK	1	25	2200/230/460
1	75	West.	SK	1	60	2300/115/230
1	75	GE	HKF	1	25	2300/115/230
3	75	A.C.	OISC	1	60	33000/2400/4160
2	100	West.	SK	1	60	2400/4800/120/240
1	100	Furnace	OISC	1	60	440/60/80/110
1	100	West.	SK	1	60	2300/115/230
1	100	GE	HKR	1	60	12000/4800
3	125	West.	OD	1	25	440/50
1	150	GE	HKR	1	60	11500/480
3	150	West.	SL	1	60	11500/230/460
1	180	Pittsburgh	OISC	3	60	440/135/110
3	200	West.	S	1	60	2400/4160/120/240
3	200	West.	SK	1	60	6900/230/460
3	200	GE	HVD	1	60	23000/2300/4600
3	667	GE	HDDP	1	60	2400/4160/230/460
3	667	GE	HDDP	1	60	4800/230/460
3	667	GE	HDDP	1	60	7200/230/460
3	667	GE	HDDP	1	60	12000/230/460
3	667	GE	HDDP	1	60	22000/2300/230/460
2	1100	West.	OISC	3	60	4160/440
2	1100	West.	OISC	3	60	4800/480
2	1500	West.	OISC	3	60	2400/4800/7200/13800/480
1	325	Furnace	OISC	1	60	4600/125
3	350	Amer*Auto	OISC	1	60	480/240/40/20

Large assortment of Current Transformers. Our stock is constantly changing, send us your requirements.

BUFFALO TRANSFORMER REBUILDING CO.

1500 NIAGARA STREET Tel. GRant 2715 BUFFALO 13, NEW YORK

MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	750	G.E.	80	2300	450
1	600	G.E.	100	440	360
1	700	G.E.	80	2300	720
1	250	G.E.	100	2300	514
1	200	Whse.	80	440	1200
1	187	G.E.	80	440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	150	Whse.	80	220/440	450
2	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
2	100	G.E.	80	440	600

With these we can supply—Manual, Semi or full magnetic reduced or full voltage control.

SQUIRREL CAGE MOTORS

3-Phase — 60 Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	Cont.	NZ-806	2300	1200
2	400	G.E.	I-K	2200	v514
1	400	G.E.	KT-412	2200	450
1	300	Whse.	CS-890	2300	1750
1	200	Whse.	CS-873-C	2200	1200
1	200	Al.Ch.	ARY	440	600
1	125	Al.Ch.	AR	2200	1750
1	125	Al.Ch.	AR	2300	514
2	125	C.W.	126-Q	440	430
1	100	Whse.	CS-663-C	440	1750
1	100	Al.Ch.	AR	550	720
1	100	Whse.	CS-938	2200	514
1	100	F.M.	H-241	440	450
2	75	Al.Ch.	AR	2200	1705
1	78	G.E.	I-K	440	600
1	75	Al.Ch.	AR	2200	720

Special—1 (new) G.E. Vertical KF-574, 2200-Volt 580 R.P.M., enclosed, hollow shaft.

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
1(3-U)	2400	Whse.	720	600	2400/4800
2	1500	G.E.	600	600	4150/2300
3	1000	Whse.	514	600	11000, 6600
4	1000	G.E.	514	600	11000/6600
1	1000	G.E.	514	600	2300
2	500	C.W.	720	575	2300/440
1	400	C.W.	1200	125/250	440/2300
2	250	Whse.	1200	125/250	2300
1	200	Ridgway	900	275	2300
2	200	Whse.	1200	125/250	440
1	155	G.E.	720	250	2300/440
2	150	Whse.	1200	250	2300
1	100	Al. Ch.	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	Ridgway	1200	275	4000/2300
1	100	C.W.	1200	125	440/220
1	85	C.W.	1200	250	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	900	75	2300
1	25	Ideal	1750	125	220
1	25	Al. Ch.	1200	250	440/220

We can furnish any of these sets with exciters and VARIABLE VOLTAGE CONTROL engineered and rebuilt to your requirements.

Motor Generator Sets of modern design, complete with control—still on their original foundations—available for immediate shipment.
(3)—G. E. 1500-KW, 250-VDC, 514 R.P.M., cpd., interpole, pole face windings, 2100-HP syn. motors, .8-PF, 13,200-V, 3-ø, 60-cy. will re-connect to 6600-V. or 4160-V.

TRANSFORMERS

Qu.	KVA	Make	Type	Phase	Voltage
3	833	Whse	OISC	1	66000/59400-2300/4160
1	2750	G.E.	H	3	13,800-2400/4160Y
3	250	Packard	A	1	13,200-2200
3	150	Packard	A	1	2300-230/460
3	100	G.E.	H	1	33,000-2300
3	25	G.E.	H	1	2400-120/240
40(new)	3	Al.Ch	OISC	1	2400-120/240

SLIP RING MOTORS—CONSTANT DUTY

3-Phase — 60 cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	1800	G.E.	MT 498	2300	357
1	1200	G.E.	MT 26	2200	277
2	1000	Al.Ch.	ANY	2200	235
1	800	G.E.	MT	2200	440
1	700	Whse.	CW	2300	720
1	600	G.E.	MT 20	2300	360
1	500	Al.Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
1	400	G.E.	MT 412	2200	440
1	250	Whse.	CW 937	440	1200
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT 414	2200	300
1	125	Whse.	CW 870	2200	900
1	100	Whse.	CW 766	440	1200
1	100	F.M.	H 20 C	440	900
2	100	G.E.	I-15A-M	2300	514

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	R.P.M
1***	3000	Whse.	Encl. (Rev.)	600
1***	2400	Whse.	Encl. (Rev.)	600
4***	1500	Whse.	Encl. (Rev.)	600
4***	1200	Whse.	Encl. (Rev.)	600
4***	800	Whse.	Encl. (Rev.)	600
1	350	G.E	CD 169 A	1150
1	200/250	El. Dy	No 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	180	G.E	MPC	400
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	90/160	G.E.	MPC	625/1125
1	100	Rel.	1050T	400/1200

All above 230-VDC except where marked***
***—Pedestal bearing mill design 525/600-VDC.
Rev.—designed for mill reversing service.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

TRANSFORMERS FOR SALE

6—1000 KVA Mol. 11500—2400/4160Y
3— 500 KVA Pitts. 22000—2300/4000Y
3— 500 KVA G-E 22000—2300/4000Y
3— 333 KVA W-H 6600—2300
3— 200 KVA G-E 22000—2300
3— 200 KVA Mol 3450—2300
3— 150 KVA G-E 44000—600/2400
3— 150 KVA G-E 19050/33000Y—2540/4000Y
3— 150 KVA A-Ch. 13800—2400/4160Y
2— 150 KVA G-E 6900—230/460
3— 100 KVA G-E 33000—6900/11950Y
3— 100 KVA G-E 13200—2300
3— 50 KVA A-Ch 33000—6900/11950Y
3— 50 KVA A-Ch 33000—2400/4160Y
3— 50 KVA A-Ch 13200—2300/4600

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
CINCINNATI 27, OHIO
40 Years Dependable Service

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

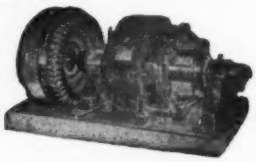
POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list . . . to

EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE
Two Rector St., New York 6, N. Y.

LATE TYPE MOTOR — GENERATOR SET

500 KW, 240 volt D.C., 900 RPM. Westinghouse Compound Wound. Serial No. 4979932. 714 HP, Syn. Motor 3/60/2200 volt, 80% P.F. Serial No. 4979926. With Mag. Reduced Voltage Starter. Factory Built Set.



MECHANICAL SPEC.
Base: 125¼" long and 59" wide
Overall Height: 60¾"
Weight: 21,600 lbs.

BENSON-WILIMZIG, INC.
1708 North Eighth St., St. Louis 6, Mo.
Phone Garfield 4290

SPECIAL TRANSFORMERS—YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

BOILERS

10 to 1000 H.P.
NEW-USED
RECONDITIONED
Steam, Gas and Electric Power Equipment
J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

MOTORS • GENERATORS • TRANSFORMERS

7 x 7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Meter—580 H. P. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. D.C. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

55" LIFTING MAGNETS

2—55" Cutler Hammer Magnets 250 Volts DC. Excellent Condition.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP G. E. Type KT 3/60/2300/1200 RPM.

150 HP G. E. Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP G. E. Type KT 3/60/440/600 RPM.

250 HP G. E. Type KT 3/60/440/720 RPM.

T.E.F.C. MOTORS

60 HP Westinghouse CS-607 3/60/440/900 X-Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 365 3/60/220/440/1800 X-Proof

15 HP Louis Allis EX-364 360/220/440/1800 X-Proof.

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.
Will make 1200 RPM 125 Volt Generators.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

333 KVA TRANSFORMERS

4—333 KVA Gen. Elect. Transformers Type H Form VRW Primary 2400/4800 Secondary 240/480 Single Phase 60 cycle with Taps. Immediate Shipment.

REBUILT TRANSFORMERS

3—100 KVA Pittsburgh 1/60/4800/230/460

3—75 KVA Pittsburgh 1/60/2300/4000Y/230/460

3—50 KVA Moloney 1/60/4800/230/460

3—50 KVA Westinghouse Type S. 1/60/2300/230/460

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy. 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

4 B&W BOILERS

WATER TUBE—ASME CODE

From ATR Tug

Built 1943

15,000 lbs. steam/hr./unit—normal
18,000 lbs. steam/hr./unit—max.
Design Pressure—268 lbs./sq. in.
Temp., degree Fahrenheit
Total steam at drum outlet (saturated) . . . 409
Forced draft—turbine driven blowers
Boiler heating surface . . . 1508 sq. ft.
Fuel . . . oil or gas

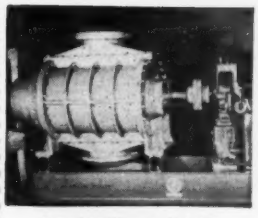
FOR DETAILED INFORMATION

WRITE — WIRE — PHONE

THE BOSTON METALS CO.
313 E. Baltimore Street
Baltimore 2, Md.
Curtis 5050

THE NATION'S

Exclusive Specialists in Rebuilding BLOWERS • FANS • EXHAUSTERS



Sutorbilt Blower—Rebuilt and Ready for Shipment

Fully Guaranteed
We Feature Leading Makes
•
IMMEDIATE DELIVERY
•

Here is the *"largest stock in the world"* of blowers, fans, and exhausters—both new and rebuilt. Our 27 years' experience and factory-trained men assure you of the best in air-moving equipment. A partial listing is shown . . . write for our detailed list.

ROTARY-POSITIVE BLOWERS

Press. Max.	Cap. Max.	Make
10	215	Roots-Con.
10	128	Sutorbilt
6	5500	Roots-Con.
6	76	Sutorbilt
5	2130	Roots-Con.
3	650	Roots-Con.
3	366	Roots-Con.
3	124	Roots-Con.
3	69	Sutorbilt

80 others in stock.

TURBO BLOWERS

Volume c. f. m.	Static- oz.	Make
410	96	Allen-Billmyre
225	96	Allen-Billmyre
3700	32	N. American
2300	24	Spencer
10400	20	Ingersoll Rand
1500	16	Spencer
1100	16	N. American
1075	16	Spencer
1000	16	Spencer
100	16	Gen. Blower

60 others in stock.

CENTRIFUGAL FANS

Size	Type	Make
49	ME	New York
3¼	W	Clarage
8	I	Bayley
7	B/C	Bayley
6	LL	Buffalo
85	5V	Sturtevant
5½	HS	American
4	LL	Buffalo
1¾	W	Clarage
3½	AHS	American
4	M	Garden City

200 others in stock.

STEEL PLATE EXHAUSTERS

Size	Type	Make
80	SS	Allington-Cur.
70	ME	Sturtevant
50	SS	Buffalo
23	IE	Clarage
55	E	American
55	Des. 1	Sturtevant
30	SP	Garden City
40	SP	Buffalo
15	IE	Clarage
35	SP	Garden City

110 others in stock.

WM. W. MEYER & SONS, INC.
8243 ELMWOOD AVE., SKOKIE, ILL.
Chicago Suburb — *Chicago Telephone* — KEystone 9-8260

AMERICAN 50 Years' Record Guarantees Satisfaction

- NEW AMERICAN AF—1 & 2 Stage—Electric Steam
- Rebuilts—Standard makes & sizes—Stationary or Portable
- Rental—Gas—Diesel—Electric—Steam
- Rebuild or Convert your Compressor

PORTABLES

60 CFM	Worthington (Gas) 2 PNEU	
70 CFM	Smith (Gas) 2 PNEU	
105 CFM	Worthington & Ingersoll	
160 CFM	Worthington (Gas) 2 & 4 PNEU	
210 CFM	Worthington (Gas & Diesel)	
315 CFM	IR & Worthington (Gas & Diesel)	
500 CFM	Worthington (Diesel) 4 PNEU	
600 CFM	Worthington (Diesel) 4 PNEU	

America's No. 1
COMPRESSOR REBUILDER
Since 1902

We have a unit for your requirements from our stock of over 300 compressors and vacuum pumps.

STATIONARY

CFM	PSI	SIZE	MANUFACTURER
44	150	5x5	Ingersoll ER-1
66	110	6x5	Penn-IR
69	125	6x6	Ingersoll ER-1
88	60	7x5	IR-Penn
93	100	7x6	American-IR
122	100	7x7	Worthington-IR
136	125	8x8	American-IR
166	135	8x9	IR-Worthington
211	100	9x9	Worthington HB
254	125	10x10	Chicago Pneu.
298	125	10½x11	American AF-1
311	40	12x8	CPT-Penn-IR
364	20	12x7	Worthington-IR
368	100	12x10	IR-CPT
379	40	12x9	Worthington HB
386	115	12x12	Ingersoll ER-1
460	125	12x13	American
503	60	14x10	IR-Sullivan
528	100	14x12	CPT-IR
628	100	14x13	Ingersoll
740	40	17x10	CPT-IR
780	55	17x12	Ingersoll ER-1
868	125	17/10x12	Chicago Pneu.
931	55	17x13	Worthington
1084	30	20x12	IR-CPT
1180	125	18/11x10	Chicago
1292	35	20x13	Worthington
1987	12	26x13	Worthington

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 47th St., North Bergen, N.J. · Union 5-4848

FOR SALE

SUPERIOR
HEAVY DUTY DIESEL

510 HP at 360 RPM—5 cylinder—14½x18—type ZDSB—non-reversing—vertical—4 cycle—cold starting—mechanical injection. Engine totally enclosed. For heavy duty pumping, dredge service, power generation, textile and saw mills, mining, etc. EXCELLENT CONDITION. IMMEDIATE DELIVERY.

30 KW GM 3-71 DIESEL GENERATOR SET

GM 2 cylinder 4½x5 diesel—radiator cooled—electric starting. Delco 3/60/440 generator—with switchgear. Skid mounted—portable.

WRITE—WIRE—PHONE

THE BOSTON METALS CO.
313 E. Baltimore Street
Baltimore 2, Md.
Curtis 5050

FOR SALE

150 K.W., 220 A.C.—125 V.D.C., 1200 R.P.M., G.E.—M.G. Set, A.C. and D.C. Panels.
4000 Ampere D.C. Switchboard.
2—2000 Ampere Generator and 4 Feeder Panels. Condition excellent.

OHIO VALLEY GENERAL HOSPITAL
Wheeling, West Virginia

A.C. MOTORS (3 Ph. 60 Cy.)

HP	MAKE	VOLTS	TYPE	SPD.	WDG.
400	Al. Ch.	2300		514	S.R.
400	G.E.	2200	MT	450	S.R.
300	G.E.	2200/4000	IM	450	S.R.
200	West.	220	CW	600	S.R.
150	G.E.	220/440	ATI	600	Syn.
125	West.	220		277	Syn.
100	G.E.	440	IM	450	S.R.

D.C. MOTORS (250 V.)

HP	MAKE	WDG.	TYPE	SPD.
400	G.E.	Cpd.	MPC	1000
300	Cr. Wh.	Cpd.	CCD	1000
200	Triumph	Cpd.		450
150	G.E.	Cpd.	DLC	800
75	G.E.	Cpd.	RC	600
60	West.	Cpd.	SK	435
20/25	West.	Series	K5	975/875

M-G SETS & ROTARIES

750 KW Al. Ch. 720 RPM 250 V. Syn. 3/60/440
2—500 KW G.E. 1200 RPM 250/125 V. Rotary
400 KW West. 1200 RPM 250/125 V. Rotary
400 KW West. 720 RPM 600 V. Syn. 3/60/2300 v.
300 KW G.E. 1200 RPM 250 V. Syn. 2300/4000 v.
240 KW G.E. 1200 RPM 250 V. Syn. 2300/4000 v.
225 KW G.E. 1200 RPM 125 V. Syn. 2300/4000 v.
150 KW G.E. 1200 RPM 250 V. Syn. 2300/4000 v.
100 KW Ridg. 1200 RPM 250 V. Syn. 2300/4000 v.
35 KW G.E. 1800 RPM 125 V. Sq. Cg. 220/440v.

MOORHEAD ELECT. MACH'Y. CO.
P.O. Box 7991P Pittsburgh 16, Pa.

DIESEL ENGINES AND GENERATING SETS

2—Hamilton 1600 HP 720 RPM Dir. Rev. G.M. 500 HP 1200 RPM 8-268A Marine.
4—General Motors Twins, Internally New
10—General Motors Quads, Navy Re-processed
3—G.M. 3-268A W/100 KW West. A.C. 440 V. 1200
2—Hercules DWXD W/Heat Ex. Twin Disc Clutch
1—Buckeye W/100 KW Elliott 3/60/240 C./400 RPM
1—Winton W/100 KW G.E. 3/60/450 V.1200 RPM
1—Superior W/100 KW Delco DC 120-240 V.1200
1—Cummins W/90 KW West. 3/60/240 V.1800 RPM
7—G.M. W/75 KVA West. 3/60/240 V.1800 RPM
1—Buda W/60 KW Century DC 120 Volt/1350 RPM
1—Cat. W/50 KW Louis Allis 3/60/110-220 V./900
2—Blackstone W/56 KVA Star 3/60/120-208 1200
1—Cummins W/40 KW West. DC 120-240 V.1200
7—Buda W/37.5 KVA Can 3/60/220-110 V.1800
1—Int. Har. 30 KW Cent. 3/60/110-220 V./1200 RPM
1—Cummins W/25 KW G.E. AC 1/60/115-230/1200
1—Int. Har W/15 KW Century 3/60/120-208/1200
1—Cat W/15 KW Louis Allis 3/60/120-208/1200
2—Waukesha Hesselman W/15 KW Century 3/60/120-208 V./1200 RPM

Partial Listing — Your Inquiries Will Receive Prompt Attention

ALBERT HELLER CO.
210 Snediker Ave., B'klyn 7, N.Y. HY 5-0800

INTAKE SCREEN

1—Link-Belt Model #46 Vertical traveling "Clean Water" Intake Screen 16'-6" centers, trays 72" wide with front spray. Capacity for screening 12,000 gallons water per minute at velocity of 1.9' per second through 100% clean screen cloth with water in screen at low level of 4'-8".

This is a new screen. It has never been used. Available for immediate shipment. For complete details and price WRITE

P. H. GLATFELTER CO.
Spring Grove, Pa.

FIRST CLASS BOILER

10000# Steam, 225# Pressure, 2 drum, stoker. Used 5 years. Also 60 HP. Vertcal Boiler.

RELIANCE WHITING CO.
ALTON, ILL.

ELECTRICAL CABLE

- For every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

450 KVA—3-60-13200-115/230 V. substation.
1000 KVA—3-60-13800-240/460 V. substation.
700 & 450 HP—180 rpm—4160-3-60 UNUSED Syn motors.
3—600 A.—15 kv GE metalclad Swgr. units.
3—500 KVA—3-60-13800-240/450 V. Transformers.
1—37½ KVA 240/480 V.—3-60 Caterpillar Diesel set.

H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

2—75 KW, GENERAL ELECTRIC 3 WIRE M.G. SETS

GENERATOR: 75 KW, type CD 1242, 250/125 volts, 1200 RPM, Compound Wound.
MOTOR: 125 HP, type K-5362, 3 phase, 60 cycles, 220/440 volts. 1200 RPM, Squirrel Cage.
Complete with DC Panels & AC (220 volts) Reduced Voltage Automatic Starters.

EMPIRE ELECTRIC CO., INC. 87 JAY STREET, BROOKLYN 1, N. Y.

If there is
Anything you want . . .
that other readers of this paper can supply
or—
Something you don't want
that other readers can use, advertise it in the
SEARCHLIGHT SECTION

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	Whse.	450
500	2200/4000	G.E.	900
450	440	Whse.	514
300	2200/440	Whse. (new)	600
300	2200	G.E.	360
300	440	Whse.	3600
250	4000/2300	G.E.	450
250	440/220	Whse.	600
250	550/440	G.E.	1200
250	440	G.E.	600
200	440/220	Whse.	514
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	2200/440	G.E.	600
150	550/220	G.E.	720
145	4000/2300	G.E.	1800
125	550/440	G.E.	1200
125	2200	G.E.	600

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	2200/440	G.E.	ATI	720
300	2300/400	G.E.	TS	720
300	2300/440	G.E.	TS	720
250	2200/440	G.E.	TS	1200
250	440/220	G.E.	ATI	600
240	2200/440	G E.	ATI	720
225	440/220	Whse.	HR	360
200	4150/2300	Whse.	G	1800
125	440/220	Whse.	HR	400
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	G.E. (25 cy.)	TS	375
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator dir. conn. to 50 hp. G.E. sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GG E., 3 pole, 600 v., air
3—1600 amp., ITE, 3 pole, 600 v., air
1—400 amp., 7500 V., G.E., outdoor, new

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2200	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
350	2300	G.E.	KT	1200
300	2200	L. Allis	FS	1800
300	2200	G.E.	FT	3600
250	2200/440	G.E.	IK	720
225 (2)	2200/440	G.E.	KT	1200
200	2200/440	G.E.	K	1200
200	440	G.E.	IK	720
200	410	G.E.	IK	514
200	440/220	G.E.	KT	1800
200	2200/440	G E.	IK	600
150	2200	Al. Chal.	AR	1800
150	220	Whse.	CS	1200
150	410	Multi sp.	KT	1800/600
150	440/220	G.E.	IK	450
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150	440/2200	G.E.	IK	514
150	2200/440	G.E.	KT	600
125	440/220	G.E.	KT(vert.)	1200
100	2200/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—275 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—187 kva, 1200 rpm, 2200/440 V., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
150	230	G.E.	CD	1750
150	230	Whse.	SK	850
120	230	Whse.	SK	350/1050
100	230	El. Dyn.	30-3	475/1250
100	230	Cr. Wh.	CMC	625
90	230	G.E.	CD	1750
80	230	G.E.	RC	600
50	230	Rel.	T	400/1200

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
250	Whse.	2200	Syn.	250
175	G.E.	220/440	Syn.	230
150	Whse.	440	sq. ca.	250
100	Al. Ch.	2300/440	sq. ca.	240/120
100	Whse.	440/220	sq. ca.	125
75	G.E.	2200/440	syn.	125
65	G.E.	2200/440	sq-ca.	250
65	G.E.	2200/440	sq.ca.	125
60	G.E.	440/220	sq.ca.	250/125
45	G.E.	440/220	sq.ca.	250
40	G.E.	440/220	sq.ca.	250/125

TRANSFORMERS 60 CY.

3— 500 kva, Whse., 24000—2300 V.
1— 300 kva, Al. Chal. 4800/4160—240/120 V., 3 phase
3— 200 kva, G.E., 11000—2300 V.
3— 200 kva, G.E., 4150—480/240 V.
3— 150 kva, G.E., 33000—2300/4600 V.
3— 150 kva, Al. Chal., 2400—240/480 V.
3— 150 kva, Al. Chal., 2400-240/120 V.
3— 100 kva, Whse., 2400-240/480 V.
6— 100 kva, Whse., 2400—120/240 V.
5— 100 kva, G.E., 4150—120/240 V.
2— 100 kva, Whse., 2400—120/55 V.
3— 75 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
3— 50 kva, Whse., 440—220/110 V., dry
6— 50 kva., G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dr.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.
1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.
2—8000 HP Webster Water Heaters.
1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 300' long.
6—Steel Coal Bunkers, 80 tons each.
1—30" Wheeler Single Stage Circulating Pump, 30,000 GPM direct connected to 300 HP Allis-Chalmers Motor, 3/25/440, 360 RPM. (Has extra impeller for 15,000 GPM)
1—4"x6" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam turbine.
1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear, Type SO, 3000 to 1200 RPM.
1—Type 1A-60 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-Stage Steam Turbine, 1750 RPM.
1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-Stage Steam Turbine, 1800 RPM.
1—Combination Circulating Pump and Condensate Pump driven by 190 HP General Electric single Stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM.
1—2" 2-stage LeCourtney Centrifugal Pump, 200 GPM 650' Heat at 3700 RPM direct connected to 53 HP Westinghouse Steam Turbine.
1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.
1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM 600 Volts DC with 1-1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.
1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.
1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.
7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.
1—Kennecott Pressure Type Industrial Water Filter.
1—50-Ton Electric Traveling Crane—55'5½" Span.

Send for Complete Inventory

MORSE BROS. MACHINERY COMPANY

2900 BRIGHTON BLVD.

P.O. Box 1708, DENVER, COLORADO

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—20,000 KW, 200# 13,200 V.
1—10,000 KW 200# 13,800 V.
1— 5,000 KW 275# 11,500 V.
1— 4,000 KW 400# 2300 V.
1— 3,000 KW 425# 13,200 V. Ext. 170# Non Cond.
1— 2,500 KW 175# 550 V. Cd.
1— 1,500 KW 150# 2300 V. Cd.
1— 1,500 KW 175# 550 V. Ext.
1— 1,250 KW 250# 2400 V. Ext.
1—1,000 KW 200# 4160 V. N.C. NEW 1949.
2— 750 KW 150# 250 V. D.C.
1— 500 KW 200# 4160 V. N.C.
1— 300 KW 125# 250 V. D.C.
2— 120 KW 150# 240 V. N.C.

DIESEL GENERATORS

1—1000 KVA 2400 volts
3— 500 KW 480 volts
1— 400 KW 480 volts
1— 300 KW 2400 volts
2— 75 KW 240/480 V.

BOILERS

2—50,000# 275# (1949)
3—15,000# 275# (1945)
1—300 H.P. 250# (1938)
2—250 H.P. 200# (1940)
1—84" HRT 150# (1942)

CRANE

1—15 Ton Span 30'-10½" Hand operated

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

THE BUYERS MUST BE SATISFIED—ALWAYS

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

FOR IMMEDIATE DELIVERY

TURBO-GENERATORS—Condensing—500 to 20,000 KW; some extraction type, pressures 200 to 450#. *ON WHAT SIZE SHALL WE QUOTE?*
TURBO-GENERATORS—Non-condensing—300 to 3000 KW. 150# to 450#. some extraction with high back pressure. *WHAT SIZE INTERESTS YOU?*
STEAM GENERATORS—30000# to 100000# per hr. 150# to 450#.
BOILERS—Water Tube, Stirling & Straight Tube types 200 to 450#.
Special 2—500 & 1-770 H.P. B&W Co. Stirling Boilers 200#—excellent condition.
2—2000 H.P. B&W Sectional Header Boilers.
BOILERS—Fire Tube, 100 to 300 HP. 100 to 250#. *WHAT BOILERS?*

TRANSFORMERS Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed. Motor-Generators, Rotaries, Frequency Changers, Large Motors & Diesel Generators.

Send us your INQUIRIES for ALL POWER MACHINERY

CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7, N. Y.

• • FOR SALE • •

BABCOCK & WILCOX BOILER

Type FF-12-16, Operating Pressure 160 P.S.I., Heating Surface 1,984 Square Feet — Acquired 1948.

PACIFIC BOILER

15-Pound Pressure, Capacity 12,500 Pounds per Hour

• Acquired 1946 •

Manning, Maxwell & Moore, Inc.

Stratford, Connecticut **Tel. BRidgeport 7-3361, Ext. 207**

Anything in ELECTRICAL EQUIPMENT

PARTIAL STOCK LIST — SEND US YOUR INQUIRIES

MOTOR GENERATOR SETS

150 KW Westinghouse 275 V, D.C. 3/60/2300-1200 RPM

150 KW Allis Chalmers 275 V, D.C. 3/60/2300-1200 RPM

ROTARY CONVERTERS

1000 KW, G.E. 600 V, D.C. 900 RPM, 6 PH. Interpole, Type NCC with transformers 13,800 V

4—500 KW WH 600 V, D.C. 1200 RPM, 6 PH. Interpole, Type HCC, with transformers 27,600 V. Automatic switchboards and automatic brush lifters.

SYNCHRONOUS MOTORS 3/60/2300

3—125 HP G.E. Type TS, Form PK, P.F.—1—900 RPM

1—175 HP G.E. Type ATI, Form PB, P.F.—1—450 RPM

1—400 HP W.H. Form IS, P.F. .8—P.B. 900 RPM

6—175 HP W.H. P.F.—1—3600 RPM, 440 V

T.E.F.C. — MOTORS

QTY.	HP	MFG.	FRAME	RPM	TYPE
1	40	Cent.	444	1750	SC
3	30	Armour	445	900	K
1	30	F.M.	405	1800	Q
1	20	Delco	405	900	
18	15	G.E.	326	1800	KGXP
13	5	W.H.	254	1750	CS
17	5		284	1150	SCXP
5	3	G.E.	225	1750	KGXP
7	2	G.E.	225	1750	KGXP

MOTORS, GEAR HEAD A.C.

2 HP Link Belt, Size DM30, XP, 3/60/220/440-45 RPM—R.B.

5 HP Link Belt, Size DM30, 3/60/220/140-84 RPM—R.B.

7½ HP W.H. TEFC, 3/60/220/440-580 RPM—R.B.

20 HP Link Belt, Size DM70, 3/60/220/440-74 RPM—R.B.

20 HP W.H. TEFC, 3/60/220/440-194 RPM—R.B.

40 HP G.E. TEFC, 3/60/220/440-561 RPM—R.B.

GEAR REDUCERS

3—Falk, Type 11HCP, 200 HP, Ratio 10:1

BUCKEYE
Trading Corporation
LARGEST STOCK IN MIDWEST
1015 to 1021 PAPIN STREET — CHESTNUT 3118 — ST. LOUIS 2, MISSOURI

SURPLUS BOILERS
A-1 Condition

100,000# hr. Sterling 450#, 125 SH
60,000 to 87,000# hr. Bent tube, 350#
55,000 to 75,000#, Sect. Header, 450# SH
50,000# hr. Cross Drum, 400#, 150 SH
60,000# hr. Bent tube, 275#. Water Walls
And others 200-250# pressure

TURBO GENERATOR UNITS 200-450#
Condensing Non. Cond. Extra Chain type

1500 KW DIESEL PLANT—Low Price

STEPHEN A. DOUGLASS CO.
630 Ft. Washington Ave., New York 33, N.Y.

FOR SALE

2—Air Compressors—Bacon Patent Air Lift 12 x 17 x 10 x 13 Ser. 21598 made by Hudson Eng. Co., N. Y.
1—Ammonia Compressor steam driver.
2—Electric Generators—Electric steam engine. 287 H.P. each generator 160 KW, direct connected. 2 exciters DC General Electric, 14 KW each—condition good.
Interested persons may write to PURCHASING AGENT, Tuskegee Institute, Alabama

FOR SALE
COMPLETE POWER PLANT

2—1000 K.W. Turbo-Generator Units; Surface Condenser; Cooling Tower; 1005 H.P. Sterling Type Boiler, 225# Op. Pres., 75000# Steam Capacity; Superheater; Feed Water Heater; Circulating Pump; Detroit Roto-Stoker; Vulcan Soot Blowers; etc. BARGAIN! Contact:

CLEARFIELD BITUMINOUS COAL CORPORATION
Indiana, Pennsylvania

PROOF POSITIVE

Yes here is *positive* proof that advertising in the SEARCHLIGHT SECTION of POWER produces results! Following are a few lines from some letters that were sent to us voluntarily:

"Our very first ad . . . placed in the November issue . . . brought us very good results as we sold a large motor generator set"

"Received splendid reaction in the way of inquiries"

"Our advertising was a worthwhile investment"

"It will not be necessary to re-run the ad as we were successful in selling the equipment through the ad"

"Excellent response to our recent advertisement in your magazine"

Such enthusiasm proves what we have been saying all along: when you want to sell used power equipment, you can do it best through the

SEARCHLIGHT SECTION
of
POWER

1—400 H.P. Keeler C.P. Integral Type Water-tube Boiler with complete Todd Oil Burner Installation. Design Pressure 160#. Built 1940.

2—500 HP Cleaver-Brooks, 150# pressure. No. 6 oil, complete with pumps and receiver. All trim.

2—500 H.P. B&W 200# w.p. Longitudinal Sectional Header Boilers. Retubed 1952. Location Massachusetts.

1—300 H.P. Titusville Scotch Marine, 125# w.p. Fully automatic, No. 6 oil, Todd Rotary Burner.

1—490 HP Walsh-Weidner sec. Hdr. Cross Drum. 450 lbs. Superheater, etc.

1—500 KW G.E. Turbine, 5 Stage with 625 KVA Alternator, 440 V., 600 sk. ft. Elliot super condenser.

2—854 HP Springfield Sec. Hdr. 225 lbs. Superheaters, etc.

2—250 HP Erie City—3 Drum lowhead. 200 lbs. —a complete Plant 1946. 200# w.p. fully automatic mechanical Peabody burning equipment. 1—Pratt-Daniels Stacks, pumps and heaters.

1—310 HP Keeler "CP" Self-Contained. 160 lbs. With or without STOKEPS. Complete Plant.

1—Babcock & Wilcox FF-15 Self-contained 160 lbs. Complete Plant—16,000 lb. each.

2—750 HP B&W Sterling, 1925, 225# w.p.

1—125 H.P. Erie City Economic, 125# pressure. Complete with stack and trim. 1946.

1—125 H.P. Cleaver-Brooks, 125# w.p., No. 5 oil, 1946, pump, receiver and breeching.

1—80 H.P. Erie City Economic, 125# w.p. Ray Oil Burner, fully automatic, return system and stack. No. 6 oil, 1940.

1—30 H.P. Cleaver Brooks Package 125# w.p. No. 2 oil, 1950.

Miscellaneous Scotch Marine Boilers, 75 to 150 H.P. available.

A Number of Self-Contained & Economic Units, 50-150 H.P., 100-200 Lbs. Pressure.

2—Detroit Roto-Spreader Stokers for 300 H.P. Boilers, nominal rating.

Combustion Engrg., Spreader Stoker complete with fan & Hogan Controls-Stoker. Designed for 600 H.P. boiler at 200% of rating, or 1200 H.P.

3—Elliot Surface Condensers, 1—900 sq. ft., 2—600 sq. ft. Located in New Jersey.

1—750 K.W. and 1—500 K.W. DC 240 V Generators dir. conn. to 2—Westinghouse non-cond. Turbines—3600 r.p.m. reduced to 900 r.p.m. on generators. Includes switchboards.

1—300 K.W. Gen. Elec. Turbo-generator set. Completely rebuilt and rewound for 220/440 V. Meludes switchboard and exciter. Presently boxed for export. Offered at an extremely low price.

WARNER J. SHERB, INC.

342 Madison Avenue, New York, N.Y.

Telephone MUrray Hill 2-9098

LAND'S 44th YEAR

MOTORS & GENERATORS, etc.

1 YEAR GUARANTEE

GENERATORS—250 V. D.C. Motor Driven

KW	Make	Type	Speed
1000	At. Ch.		720
250	Cr. Wh.	CCD	1200
200	West (2)	SK-18	1200
150	West.	SK	900
125	G. E. (2)	MPC	1200
125	Fl. Dy.	20L	1750
100	Delco (4)		1150
75	Cr. Wh.	51H	1150
50	Cr. Wh.	HH	1150
40	West.	SK	1750
35	G. E.	RC	1750
35	Al. Ch. (4)	3 wire	1750
25	G. E.	CS	1200
15	Star		1750
7½	West.	SK-43	1750
5	West.	SK-284	1750
5	Rel.	T-23T	1750
3	Rel	T-14T	1740

GENERATORS—Low Voltage D.C.

Amp.	Make	Voltage
10,000	H-V-W	6
10,000	J-L	10
6000	El. Prod.	18/36
5000	H-V-W	6/12
4000	North	7½
3000	Chandey.	12
2500	Chandey.	6/12
1500	H. V. W.	6/12
750	H-V-W-	6/12
1000	G. E.	15
1000	G. E	25
1000	West	24
100	Diehl	32
200	West.	35
200	Burke	35
125	Diehl	40
500	G. E.	32
1500	Century	45
3200	G. E.	50
325	West.	50
1000	G. E.	75

230 V. D.C. MOTORS

H.P.	Make	Type	Speed
250/200	Rel.	2600T	400/800
150	West.	SK	1150
150	West.	Sk	850
125	Rel.	T	600
125/50	E. D.	20-SL	1750 1315
100	West. (4)	SK	1150
100	West. (6)	Sk	850
100	Rel.	651-T	850
100	G. E.	RC	600
100	Rel	1060T	500
100	A-C		1150
100	FM	TRC-38	725
110/55	G. E.	DMC	800/400
90/45	G. E. (2)	RF-17	950/475
75	G. E.	CD-155	1150
75	West. (6)	SK	1150
75	G. E.	RC	1000
75	Rel.	461-T	850
75	West. (2)	SK	850
75	West.	SK	475
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	850
60	West.	SK-160	680
60	West.	SK	250/1000
50	Cr. Wh.	CMC-FH	1750
50	G. E.	CD-93	3600
50	West.	SK-160	565
50	G. E.	RF-17	250/1000
40	G. E. (3)	CD-105	850
40	Cr. Wh.	FH	1750
40	West (5)	SK	775
35	E-D	258	350/1050
35	West.	SK	250/1050
35	West	SK	1150

SLIPRING MOTORS

H.P.	Make	Type	Speed
600	Cr. Wh.	131-AQ	507
500	G. E. (2)	IM	450
200	G. E.	MT-559Y	1175
150	G. E.	IM	870
125	West.	CW	1750
125	G. E.	IM	580
100	G. E.	MT347	1150
100	G. E.	IM	690

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
250	GE(TENV)	K-6335	1750
200	Wagner	RP2-26Z	1800
200	West.		1750
200	A. Ch.	AR	885
200	G. E.	KF-6335	880
150	West.	CS	1175
150	G. E.	IK	580
125	A. Ch. (2)	53R	3500
125	A. Ch. (5)	AR	1890
125	Century		3500
125	A. Ch.		690
100	West.	CS6078	3540
100	West.	CS	870

Partial Listing Only!

Please Send Us Your Inquiries

L. J. LAND, INC.

Established 1910

156 GRAND STREET, NEW YORK 13, N. Y.

CAnal 6-6976

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	Make	Type	Speed	Description
400	G.E.	I-M	1200	S.B.
300	G.E.	I-M	1200	S.B.
200	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1800	S.B.
100	G.E.	MT-300	1800	S.B.
100	G.E.	I-M	900	S.B.
100	G.E.	I-M	720	S.B.
75	G.E.	MT-343	1200	S.B.
75	G.E.	I-M	900	S.B.
75	West.	CW	720	S.B.
75	G.E.	I-M	720	S.B.
60	G.E.	MT-333	1800	S.B.
40	G.E.	I-M	1800	S.B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	Make	Type	Speed	Description
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-607S	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBBused
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	K-594S	1800	TEFCBBXP
60	G.E.	OG-44	1800	TEFCBBXP
60	L.A.	QS-444	1800	B. B. open
60	F.M.	FB-404	3600	B. B. open
50	Master	K-445	1800	TEFCBBXP
50	G.E.	K-405	1800	TEFCBB
50	G.E.	CS-445	1200	S. B. drip
50	West.	K-505	900	S. B. open
50	G.E.	AR-444	3600	TEFCBBXP
40	A.C.	KF-365S	3600	TEFCBBXP
40	G.E.	CS-405	1800	B. B. Splash
40	West.	K-405	1800	TEFCBB
40	L.A.	404	1800	TEFCBBXP
40	G.E.	CS-504S	1800	B. B. open

REBUILT SQUIRREL CAGE MOTORS

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	Make	Type	Speed	Description
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM. We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER

EQUIPMENT COMPANY

8 CAIRN ST., ROCHESTER 2, N. Y.

P. O. BOX 534 — Tel: Genesee 5629

ADVERTISERS' INDEX

This index is a service to readers. Every effort is made to maintain its accuracy, but POWER cannot assume responsibility for errors or omissions. When a star appears after the name, the advertisement does not appear in this issue but appeared in an issue within the previous three months.

Air Preheater Corp. 187
Allen-Sherman-Hoff Co. Second Cover
Allis-Chalmers Mfg. Co. 4, 18-19, 35, 50, 65, 141
Allpax Company 210
Aluminum Co. of America 284
American Blower Co. 33-34
American Brake Shoe Co. (Brake Shoe & Castings Div.) 242
American Chain & Cable Co. 190
American Chimney Co. 288
American District Steam Co. 164, 282
American Engineering Co. *
American Locomotive Co. (Alco Products Div.) 211
American Pulverizer Co. 62
Ames Iron Works *
Anchor Packing Co. 237
Anderson Co., V. D. *
Arabol Mfg. Co. *
Arkansas Fuel Oil Co. 203
Armstrong Machine Works 139

Babbitt Steam Specialty Co. 250
Babcock & Wilcox Co. 6-7
Badger Mfg. Co. 244
Bailey Meter Co. 16-17
Baltimore & Ohio Railroad 151
Belco Industrial Equip. Div., Inc. *
Bell & Gossett Co. 247
Belmont Packing & Rubber Co. 246
Bethlehem Steel Co. 283
Betz Co., W. H. & L. D. 137
Biddle Co., James G. *
Bigelow Company 216
Bituminous Coal Institute 20-21
Black, Sivalls & Bryson Inc. *
Blaw-Knox Construction Co. *
Boiler Tube of America 224
Bonney Forge & Tool Works 68
Borden Metal Products Co. *
Botfield Refractories Co. 284
Brown Boveri Corp. *
Buell Engineering Co. 226
Buffalo Forge Co. 227
Buffalo Pumps, Inc. 287
Builders-Providence, Inc. 282
Burgess-Manning Co. 222
Bussmann Mfg. Co. 70-71
Byers Co., A. M. 72
Byron Jackson Co. *

Carey Mfg. Co., Philip *
Cash Co., A. W. 40
Catawissa Valve & Fittings Co. *
Chapman Valve Mfg. Co. 171
Chase Brass & Copper Co. 273
Chelsea Fan & Blower Co., Inc. *
Chesterton Co., A. W. 104
Chicago Metal Hose Div. Flexonics Corp. 236
Chicago Pneumatic Tool Co. *
Cities Service Oil Co. 203
Clarage Fan Co. 258
Clark Mfg. Co. *
Cleaver-Brooks Co. 241
Cochrane Corp. 44-45
Combustion Control Corp. *
Combustion Engrg.-Superheater Inc. 28-29
Conoflow Corp. *
Cooper-Bessemer Corp. 274
Copes-Vulcan Div., Continental Foundry & Mach. Co. 12-13, 14-15
Crane Company 64, 157
Crane Packing Co. 178
Cyclotherm Corp. *

Darling Valve & Mfg. Co. *
Dart Union Co. 188
Davis Regulator Co. 250
Dearborn Chemical Co. *
DeLaval Separator Co. 223
DeLaval Steam Turbine Co. 2
Deming Co. *
Detroit Stoker Co. 22-23
Diamond Power Specialty Corp. 8-9
Dodge Mfg. Corp. *
Dowell, Inc. 169
Dravo Corporation *
Drew & Co., E. F. 205

Eastern Gas & Fuel Associates *
Edward Valves, Inc. 60-61
Electric Machinery Mfg. Co. *
Elgin Softener Corp. *
Elliott Company 10-11, 174
Elliott Co., (Lagonda Div.) *
Engineer Company 238
Erico Products, Inc. 256
Erie City Iron Works 179
Ernst Water Column & Gage Co. 288
Everlasting Valve Co. 194

Fisher Governor Co. 225
Flexitallic Gasket Co. *
Flexonics Corp. 236
Fluor Corp., Ltd. 189
Forty-Eight Insulations, Inc. 182
Foster Engineering Co. 212
Foster Wheeler Corp. 159
Foxboro Co. *
Frick Company 232
Fuller Company 277

Garlock Packing Co. 275
General Electric Co. (Apparatus Dept.) 26-27, 46-47, 51-52, 58-59
General Electric Co. (Construction Mat. Div.) *
General Refractories Co. *
Globe Steel Tubes Co. 163
Golden Anderson Valve Spec. Co. 204
Goodrich Co., B. F. 34A-34B-34C-34D
Goulds Pumps Inc. *
Graver Water Conditioning Co. 266
Green Fire Brick Co., A. P. 255
Green Fuel Economizer Co. 186
Green, Tweed & Co. 280
Grinnell Co. Third Cover
Griscom-Russell Co. 264
Gundlach Machine Co., T. J. 214

Hagan Corp. 54-55, 269
Hall Laboratories 185
Haynes Products Co. 288
Hays Corp. 265
Hendrick Mfg. Co. *
Henszey Co. 240
Hewitt-Robins, Inc. 66-67
Heyl & Patterson, Inc. 251
Hill Pump Valve Co. *
Hilliard Corp. *
Hills-McCanna Co. *
Hoffman Specialty Mfg. Corp. *
Hudson Engrg. Corp. *

Illinois Water Treatment Co. *
Infilco Inc. 170
Ingersoll-Rand Co. 213
International Nickel Co. 278
Iron Fireman Mfg. Co. 24-25

Jefferson Union Co. 214
Jeffrey Mfg. Co. 199
Jenkins Bros. 146-147
Jerguson Gage & Valve Co. *
Johns-Manville 153
Johnson Service Co. *
Johnston Pump Co. *
Joy Mfg. Co. 197

Keasbey & Mattison Co. 285
Keckley Co., O. C. *
Kellogg Co., M. W. 231
Kennedy Valve Mfg. Co. 252
Kennedy-Van Saun Mfg. & Engrg. Corp. 56-57
Kewanee-Ross Corp. *
Key Co. *
Klippel Valves Inc. *
Klöckner-Humboldt-Deutz A. G. Köln 286
Kold-Hold Mfg. Co. (Platecoil Div.) 198
Koppers Co., Inc., Coupling Dept. *
Kuljian Corp. *

Ladish Co. 235
Lee Corp. 234
Leeds & Northrup Co. 257
Leslie Co. 249
Link-Belt Co. 1
Lockett & Co., A. M. *
Lonergan Co., J. E. 246
Lubriplate Div., Fiske Bros. Refining Co. 220
Lummus Co. (Western Piping Supply Div.) 280
Lumnite Div. Universal Atlas Cement Co. 272
Lunkenheimer Co. 239

Manning, Maxwell & Moore, Inc. 260
Marley Co. 217
Marsh Corp., James P. *
Martindale Electric Co 250
Mason-Neilan Regulator Co. *
McGraw-Hill Book Co. 238
McKiernan-Terry Corp. *
Mercoid Corp. 286
Midwest Piping Co., Inc. (Formerly Midwest Piping & Supply Co. 175
Industrial Div. Minneapolis-Honeywell Reg. Co. 48-49
Mundet Cork Co. *

Murray Co., Inc., A. B. ... *
Murray Mfg. Co., D. J. ... 224
Murray Iron Works Co. ... *

National Airoil Burner Co., Inc. ... 230
National Aluminate Corp. ... 145
National Conveyors Co., Inc. ... 228
National Tube Co. ... *
National Valve & Mfg. Co. ... 268
New Hermes Inc. ... 280
Niagara Blower Co. ... 176
Nicholson & Co., W. H. ... 232
Nordberg Mfg. Co. ... 206, 254

Oakite Products, Inc. ... 228
Ohio Injector Co. ... 245
Orr & Sembower Inc. ... 253
Owens-Illinois Glass Co. (Kaylo Div.) ... *

Panalarm Products, Inc. ... *
Panellit, Inc. ... 191
Pangborn Corp. ... *
Parker Appliance Co. ... *
Peabody Engrg. Corp. ... 208
Peerless Pump Div., (Food Machy & Chemical Corp.) ... 279
Penberthy Injector Co. ... 270
Penfield Mfg. Co., Inc. ... *
Perfex Corp. ... *
Permutit Company ... Back Cover
Perolin Company, Inc. ... *
Petro ... *
Phelps Dodge Copper Products Corp. ... *
Philadelphia Gear Works ... 177
Pittsburgh Corning Corp. ... *
Pittsburgh Piping & Equipment Co. ... 276
Powell Co., Wm. ... 181
Powers Regulator Co. ... 129
Preferred Utilities Mfg. Co. ... 218
Pure Oil Co. ... 229
Pyle-National Co. ... 206

Ranney Method Water Supplies, Inc. ... *
Raybestos-Manhattan Inc., Manhattan Rubber Div. ... 243
Reading, Pratt & Cady Div. ... 190
Republic Flow Meters Co. ... 42-43
Republic Mfg. Co. ... *
Republic Steel Corp. ... *
Research Corp. ... *
Revere Copper & Brass, Inc. ... *
Ric-Wil Company ... 286
Ridge Tool Co. ... 172
Riley Stoker Corp. ... 102-103
Rohm & Haas Co. (Resinous Prod. Div.) ... *
Roto Div. of Elliott Co. ... 200

Sarco Company ... 207
Schaub Engrg. Co., Fred H. ... 281
Schramm, Inc. ... *
Sea-Ro Packing Co., Inc. ... *
Sier-Bath Gear & Pump Co. ... *
Simplex Valve Meter Co. ... 240
Sims Pump Valve Co., Inc. ... 284
Sinclair Refining Co. ... 219
Skinner Engine Co. ... *
Smith Corp., A. O. ... *
Socony-Vacuum Oil Co. ... *
Sorenson & Co., Inc. ... *
Spence Engineering Co. ... 202
Springfield Boiler Co. ... 41
Squires Co., C. E. ... *
Standard Oil Co. of Indiana ... 143
Steel & Tubes Div. ... *
Stephens-Adamson Mfg. Co. ... 173
Stickle Steam Specialties Co. ... *
Stock Equipment Co. ... 221
Stone & Webster Engrg. Co. ... 201
Strong, Carlisle & Hammond Co. ... 192
Struthers Wells Corp. (Titusville Iron Works Div.) ... 210
Sun Oil Company ... 135
Superior Combustion Industries ... 63, 167
Swartwout Company ... 161

Taylor & Co., W. A. ... 220
Taylor Instrument Co's ... 312
Tennessee Corp. ... *
Terry Steam Turbine Co. ... 267
Texas Company ... *
Tidewater Associated Oil Co. ... 195
Tube Turns, Inc. ... 183-184

Union Asbestos & Rubber Co. ... 259
United Cooling Tower Co. ... *
United States Gasket Co. ... 196
U.S. Electrical Motors, Inc. ... *
U.S. Steel Corp. ... *
United States Rubber Co. (Elect. Wire & Cable Dept.) ... 193
United States Rubber Co. (Mech. Goods Div.) ... *

Van Der Horst Corp. ... 233
Viking Pump Co. ... *
Vogt Machine Co., Henry ... 261

Wallace & Tiernan Co., Inc. ... 180
Walworth Company ... 271
Warren Steam Pump Co. ... *
Water Cooling Equipment Co. ... *
Watson-Stillman Fittings Div., H. K. Porter Co., Inc. ... 209
Western Chemical Co. ... *
Western Precipitation Corp. ... 289
Westinghouse Electric Corp. ... 38-39, 155
Westinghouse Electric Corp. (Sturtevant Div.) ... 149
Wheeler Mfg. Co., C. H. ... *
Wheeler Economy Pumps ... *
Where to Buy ... 288
Wickes Boiler Co. ... 215
Wiedeke Co., Gustav ... *
Wing Mfg. Co., L. J. ... 248
Winslow Engrg. Co. ... *
Worthington Corp. ... 30, 31, 32

Yarnall-Waring Co. ... 36-37, 53, 131

Zallea Bros. ... *

Professional Services ... 288

SEARCHLIGHT SECTION

(Classified Advertising)

H. E. HILTY, MGR.

EMPLOYMENT
Positions Vacant ... 290, 291
Positions Wanted ... 290
Selling Opportunities Wanted ... 290
Employment Services ... 290

EDUCATIONAL
Bulletins ... 291

EQUIPMENT
(Used or Surplus New)
For Sale ... 291-309

WANTED
Equipment ... 291

ADVERTISERS INDEX
Aljon Electrical Diesel Co. ... 300
Alton Box Board Co. ... 291
American Air Compressor Corp. ... 306
American Electric Corp. ... 302
Arrow Transformer Co. ... 304
Belyea Co., Inc. ... 301
Benson-Wilmzig Inc. ... 304
Bissell & Assoc., Benjamin ... 302
Boston Metals Co., The ... 299, 305, 306
Buckeye Trading Corp. ... 308
Buffalo Transformer Rebuilding Co. ... 303
Chicago Electric Co. ... 295
Clearfield Bituminous Coal Corp. ... 308
Dalton Supply Co. ... 298
Darien ... 298
Denny & Clark ... 303
DeRose, G. M. ... 301
Douglas Co., Stephen A. ... 308
Ebasco Services Inc. ... 304
Electric Equipment Co., Inc. ... 291, 297
Electric Service Co., Inc. ... 304
Ellis Co., A. Lee ... 307
Empire Electric Co., Inc. ... 306
Erie Electric Co., Inc. ... 305
Glatfelter Co., P. H. ... 306
Glow Electric Co. ... 303
Goodyear Atomic Corp. ... 291
H & P Machinery Co. ... 301
Hall & Co., Stephen ... 307
Heller & Co., Albert ... 306
Hemphill & Co., J. I. ... 302
Henault Co., Philip A. ... 300
International Power Machinery Co. ... 300
Johnson & Assoc., H. Blaine ... 306
Keck's Sons, Wm. ... 302
Land, L. J. ... 309
Lestan Corp. ... 300
MacCabe Co., T. B. ... 304
Manning, Maxwell & Moore Inc. ... 307
Merrill & Co. ... 302
Meyer & Sons, Inc., Wm. W. ... 305
Mississippi Valley Equipment Co. ... 301
Moorhead Electrical Machinery Co. ... 306
Morse Brothers Machinery Co. ... 307
National Electric Service Co. ... 298
Newman & Co., Inc. ... 301
O'Brien Machinery Co. ... 296
Ohio Valley General Hospital ... 306
Penn Machinery Co. ... 301
Perry Equipment Corp. ... 300
Pierce Cable Co. ... 291
Pittsburgh Consolidated Coal Co. ... 291
Power Equipment Co. ... 309
Power Plant Equipment Co., Inc. ... 299
Rearick, Charles B. ... 307
Reliance Whiting Co. ... 306
Renner Brewing ... 302
Roder-Blackburn International Corp. ... 309
Schoonmaker Co., Inc., A. G. ... 298
Sherb Inc., Warner J. ... 309
Smith Co., H. Y. ... 300
Soul Clinic Inc. ... 291
Stock Equipment Co. ... 291
Strickler & Assoc., Dean C. ... 303
Tampa Armature Works ... 309
Thompson Co., Inc., J. Parker ... 304
Tuskegee Institute ... 308
Universal Wire & Cable Co. ... 306
Utilities Machinery Corp. ... 294
Veterans' Village Inc. ... 291
Wagner Co., Arthur ... 292
Walker & Collins ... 291
Weaver, Charles ... 293
Winston Machinery Co., Inc. ... 301

WHICH ONE OF THESE TAYLOR INSTRUMENTS WILL SAVE YOU THE MOST ?

RECORDING FULSCOPE* CONTROLLER

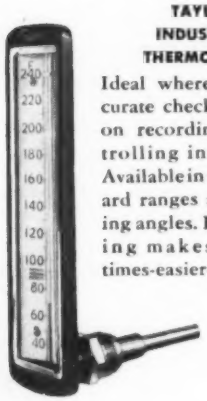
For desuperheaters, or for any close, accurate control of temperature, pressure, flow or liquid level. Quickly adapted to operating requirements.

RECORDING THERMOMETER OR PRESSURE GAUGE

Ideal wherever you need a record of pressure, temperature or a combination of both. For example, accurately records steam and feed water temperatures and pressures, or oil, air and flue gas temperature.

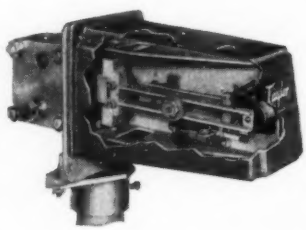
NEW 6" DIAL INDICATOR

For temperature and pressure measurements. Has an all-new design movement for greater sensitivity on any type of measuring job. New case can be flush or face mounted, is fume and moisture proof. Big selection of standard ranges.



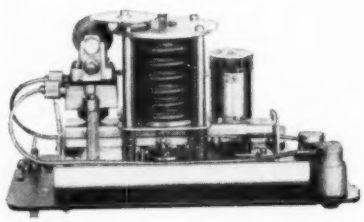
TAYLOR INDUSTRIAL THERMOMETER

Ideal wherever an accurate check is needed on recording or controlling instruments. Available in many standard ranges and mounting angles. BINOC* tubing makes it three-times-easier-to-read.



TAYLOR TRANSAIRE* DIFFERENTIAL PRESSURE TRANSMITTER

A rugged, dependable and accurate instrument designed to measure flow, liquid level or specific gravity. Taylor's latest addition to Transet System of transmitters, receivers and controllers.



TAYLOR TRANSAIRE TEMPERATURE TRANSMITTER

Compact, super-responsive, designed to measure and transmit smallest temperature changes up to 1,000 feet with great accuracy. Provides dynamic accuracy, thanks to derivative action in the measuring circuit.

ANY ONE of these instruments can help you cut costs and increase efficiency. From a single thermometer to the complete TRANSET* Pneumatic Control System, Taylor has the answer to many power plant problems. Why not ask your qualified Taylor Field Engineer, or write for full information as to how we can help you. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

*Reg. U. S. Pat. Off.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Sunbury Plant of Pennsylvania Power & Light Co., Sunbury, Pa.

Pennsylvania Power & Light Company's

SUNBURY STATION

world's largest anthracite-fired steam electric plant, is "supported" by

GRINNELL HANGERS

Pennsylvania Power & Light Company at its Sunbury Plant faced the problem of providing flexible, but constant support, to main steam piping carrying superheated steam under a pressure of 1350 pounds per square inch, and at a temperature of 950°F.

For "support" on that tough assignment . . . Pennsylvania Power & Light turned to Grinnell. And that is understandable. Grinnell is America's No. 1 supplier of pipe hangers and supports. Grinnell combines modern manufacturing with expert background knowledge gained during a century of piping specialization. Grinnell, and Grinnell alone, can offer these advantages:

- Complete "start to finish" production facilities — including research, design manufacturing, engineering and field service.
- Practical experience in every type of piping gained during the past 100 years.
- Coast to coast distribution — enabling "out of stock" purchases, anywhere.

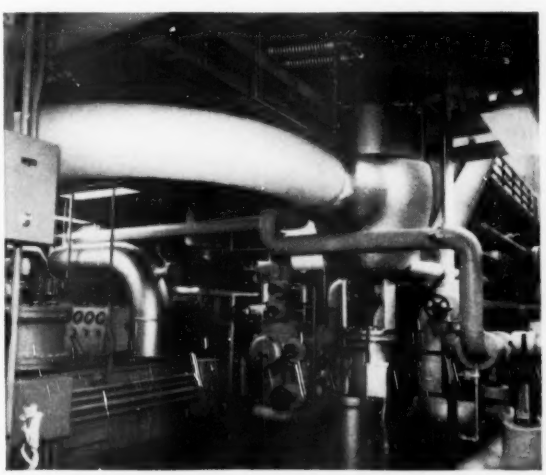
Call on Grinnell . . . "whenever piping is involved."

GRINNELL MODEL L CONSTANT-SUPPORTS maintain full safety factor in high temperature, high pressure systems. 3 physical structures accommodate maximum travel requirements of 2½, 5 and 10 inches; 16 sizes collectively cover numerous load ranges between 141 and 19,530 pounds.

GRINNELL PRE-ENGINEERED SPRING HANGERS — maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes. 16 sizes available from stock — load range from 74 pounds to 9000 pounds.

GRINNELL VIBRATION CONTROL AND SWAY BRACES—dampen vibration, oppose pipe sway and absorb shock. 3 sizes give full deflection forces from 200 to 1800 lbs.; have initial precompressed spring forces from 50 to 450 lbs. respectively.

Twin Grinnell Constant Support Hangers provide uniform lift for steam turbine throttle valve to prevent stresses in piping as it moves from "cold" to "hot" positions.

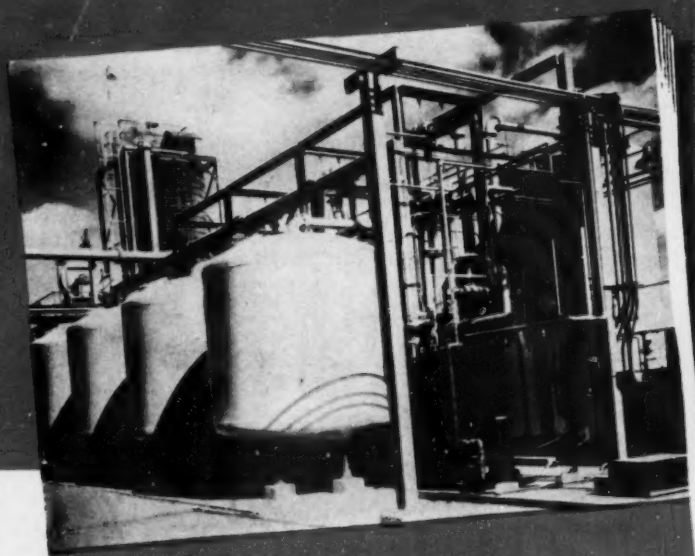


GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPLIES

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



DEMINERALIZATION
including SILICA REMOVAL
by **PERMUTIT**
ION EXCHANGE

GET THE FACTS

. . . about Permutit Demineralizers for Purer Make-up . . . Lower Cost

You'll want this interesting booklet! Flow diagrams, illustrations and specifications explain key methods of demineralization and silica removal by Permutit ion exchangers and equipment. Write for your free copy —today!

HIGHEST PURITY MAKE-UP Effluents of Permutit Demineralizers have contained *total* electrolytes as low as 0.01 ppm, and silica as low as 0.01 ppm. Under service conditions, values may be slightly higher. In comparison, most distilled water contains 20 to 100 times more electrolytes . . . yet costs much more to produce.

REDUCES B.T.U. COST PER KW-HR The chemical cost for demineralization is usually less than the fuel cost for evaporation of boiler feed make-up. The installed equipment cost for demineralization is also usually less than for evaporation.

ELIMINATES CONDENSATE SHORTAGES A demineralizer is operated independently of the turbine. It may be operated at full capacity if required, even though the turbine is running light and some boilers are standing by idle. It is possible to start boilers of a new plant with demineralized water. If a demineralizer is not in service, condensate may be imported from another station to avoid starting boilers with raw water.

ION EXCHANGERS MEET ALL REQUIREMENTS Choice of units and layout of demineralization and silica removal equipment depend on composition of the water, flow rates, end-use requirements. Permutit makes all types of ion exchange resins and equipment . . . can save you time and money in the specification of the one combination that best fills your needs.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER FORTY YEARS

THE PERMUTIT COMPANY, DEPT. P-4
330 West 42nd Street, New York 36, N.Y.

Please send my copy of "Demineralization including Silica Removal by Permutit Ion Exchangers."

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

In Canada: Permutit Company of Canada Ltd.
6975 Jeanne Mance Street, Montreal